CYCLONE MEMOIRS,

PART IV.

ARABIAN SEA.

AN INQUIRY

INTO THE

NATURE AND COURSE OF STORMS

IN THE

ARABIAN SEA

AND A

CATALOGUE AND BRIEF HISTORY OF ALL RECORDED CYCLONES IN THAT SEA

From 1648 to 1889.

BY

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PREFACE.

THE present work is intended to supply a want which was felt by the Simla Meteorological Office when it took over the work of warning the Bombay Coast ports in August 1888. There were no track charts for different months of the storms in the Arabian Sea available for reference, and only one report of a cyclone in the Arabian Sea had been published by the India Meteorological Department between the years 1875—88. I therefore asked Mr. Dallas, to whom was entrusted the duty of issuing storm warnings to the Bombay Coast ports, to collect all the available information respecting previous storms in the Arabian Sea, and to prepare storm charts for the different months of the year in order to ascertain, so far as possible, whether the storms at different seasons followed definite tracks and were confined to definite portions of the Sea. The available information was found to be more limited than was hoped for, but it enabled Mr. Dallas to draw up a brief history of all the more severe storms that have been known to occur in that sea, to prepare storm charts and to establish conclusions as to the law of occurrence of storms and their tracks at different seasons which will probably prove of considerable use to mariners navigating the Arabian Sea. It is for their use chiefly, therefore, that the present work has been published.

It is hoped that the information which is now systematically collected from the great majority of vessels entering the port of Bombay will throw much light upon the causes and conditions of storm generation, development and movement in that sea, and enable the Department to issue at some future date a more complete and satisfactory work on the subject of these storms for the use of sailors than is at present possible.

The Editor of these Memoirs does not necessarily agree with, or hold himself responsible for all, the theoretical views put forward by the writers of the various Memoirs.

JOHN ELIOT,

Meteorological Reporter to the Government of India.

METEOROLOGICAL OFFICE;
The 5th June 1891.

CYCLONE MEMOIRS, PART IV.

ARABIAN SEA.

THE STORMS OF THE ARABIAN SEA.

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Introduction.

IN the following pages is collected together all the more important information which has hitherto been published on the subject of storms in the Arabian Sea. The paper is divided into two parts—the first giving the details of each storm separately in its chronological order, the second treating of the distribution and movements of the storms according to months and seasons, and giving the opinions of past meteorologists on the characteristics of the cyclonology of the Arabian Sea. The authorities who have been consulted are principally Piddington, Buist, and Chambers (F.), while the whole of the records of the Bombay Meteorological Office have been placed at the disposal of the author. The information is admittedly incomplete, even in the first part, where the details of each storm are given. It will be often noticed that the records on which the motion and position of the various storms are founded are meagre in the extreme; while in the second part, where the distribution of storms in time and space is discussed, it has frequently been necessary to accept the bare mention of the occurrence of a storm without any reference to its intensity, its origin, or its progress. The present paper is, however, in the main a collection, from records scattered through various publications, of facts which have been noted in the past, and is designed as a basis on which the study of the storms of the Arabian Sea may be founded. The information available refers to a very restricted area. Along the Indian coast, from Sind to Cape Comorin, and across the Indian Ocean from Bombay to Aden, the record of all the larger, and more disastrous, storms of later years is probably fairly complete and exhaustive, but from the whole expanse of ocean extending from the Maldives and Laccadives to the African coast there is practically no record of storms, and whether this hiatus is due to the absence of information or to the absence of cyclones only future investigations can decide. That during the south-west monsoon the winds in that

region frequently attain the force of a fresh to strong gale is shown by a reference to the Arabian Sea Meteorological Charts compiled by the writer, but these gales are apparently in nearly all cases merely an abnormal strengthening of the ordinary monsoon current, and are not cyclonic in their origin. They are among the ordinary phenomena of the Indian Ocean, and, save under very exceptional circumstances, can hardly be considered as a source of danger to a well-appointed ship. All record of such occurrences has consequently been omitted from the following pages, which deal solely with cyclonic phenomena.

PART I.

CATALOGUE OF CYCLONES IN ARABIAN SEA—DESCRIPTIONS OF THE VARIOUS STORMS—CYCLONIC PHENOMENA OBSERVED BEFORE AND DURING THE PROGRESS OF THE VARIOUS STORMS.

Catalogue.

The full list of gales in the Arabian Sea derived from the authorities quoted at the commencement is as follows :—

List of Gales in Arabian Sea.

No.	Date.			Details of storm.	Coasts affected.
	Year.	Month.	Days.		
1	1648	May . .	27th . .	Furious hurricane from Bombay, northwards.	N. Konkan, Kattiawar.
2	1762	May . .	?	Hurricane off Goa . . .	S. Konkan.
3	1779	April .	About middle of month.	Hurricane near Anjengo. *Cruiser* lost.	Malabar.
4	1782	April .	20th and 21st	Heavy southerly storm, west coast. Several large ships foundered at Surat.	Malabar to Gulf of Cambay.
5	1782	May . .	20th . .	Storm off Calicut . . .	Malabar.
6	1783	November	3rd to 7th .	Violent hurricane, Tellicherry to Bombay.	Malabar, Konkan.
7	1799	November	3rd to 7th .	Hurricane, Calicut to Bombay. Her Majesty's ship *Resolution*, 1,000 small craft, 400 lives lost, Bombay Harbour.	West coast (whole).
8	1805	January .	7th . .	Hurricane at Tellicherry . .	Malabar.
9	1807	June . .	24th . .	Hurricane off Mangalore .	Malabar.
10	1811	June . .	4th and 5th	Cyclone Long. 70° E., Lat. 16° N.	None.
11	1819	September.	25th . .	Hurricane, Cutch and Kattiawar	Cutch and Kattiawar.
12	1820	May . .	8th . .	Hurricane, southward of Bombay.	S. Konkan.
13	1831	December .	17th . .	120 miles W. of Dwarka. East India Company's *Elphinstone* experienced gale from S.-E. through E. to N.-E.	Kattiawar.
14	1836	June . .	8th and 9th .	Cyclone in Lat. 23°N. and Long. 63° E.	None.
15	1837	June . .	15th . .	Hurricane, Bombay . .	N. Konkan.
16	1842	October and November.	October 22nd to November 2nd.	Cyclone crossed from Madras and traversed Arabian Sea to Aden.	Malabar(?).
17	1845	Novr.-Decr.	November 29th to December 6th.	Cyclone from Bay crossed Ceylon and Cape Comorin and traversed Arabian Sea to Lat. 13° N. and Long. 60° E.	Malabar and Ceylon.
18	1846	November .	25th and 26th	Cyclone from Madras crossed to Mangalore and Cochin.	Malabar.
19	1847	April .	16th to 19th .	Cyclone experienced on west coast from Malabar to Sind. Laccadive Islands sub-merged. 1,000 people perished. Storm reached Muskat two days after passing Bombay.	Malabar, S. Konkan, N. Konkan, Cutch, Kattiawar, Sind.
20	1848	April .	23rd . .	Hurricane off Ceylon . .	None.
21	1851	May . .	7th and later	Cyclone crossed Peninsula .	Malabar, S. and N. Konkan, Cutch, Kattiawar, Sind.

List of Gales in Arabian Sea.

No.	Date. Year.	Month.	Days.	Details of storm.	Coasts affected.
22	1851	November.	21st . .	Gale between Bombay and Karachi. *Surat* foundered.	None.
23	1853	March .	26th to 28th.	Furious hurricane, Southern India.	Doubtful if felt in Arabian Sea.
24	1854	October .	6th . .	Hurricane S. of Ceylon . .	Ceylon.
25	1854	November.	1st and 2nd .	Hurricane, Bombay. Cyclone passed along Konkan and Goa coasts from southward.	N. Konkan.
26	1855	October .	29th and 30th	Cyclone in Arabian Sea, Lat. 14° N., Long. 55° E. centre travelling from N.-E. to S.-W.	None.
27	1856	April .	18th to 20th .	Cyclone, Arabian Sea, between Kooria Mooria and Aden.	South Arabian coast.
28	1857	November	20th . .	Hurricane, west coast of Ceylon	Ceylon.
29	1858	May . .	15th to 20th .	Cyclone from Bay crossed to Malabar.	Malabar.
30	1859	April .	21st to 28th .	Cyclone crossed Peninsula to Tellicherry.	Malabar.
31	1859	June .	2nd and 3rd .	Cyclone, Arabian Sea, Lat. 15°, N., Long. 66° E.	S. Arabian coast.
32	1862	November	19th to 23rd .	Cyclone off west coast of India. Peninsular and Oriental *S. S. Columbia* lost on Minikoi.	West coast (whole).
33	1863	January .	18th . .	Gale in Lat. 22° to 23°N., Long. 60° 30′E.; lasted 4 days.	None.
34	1864	April . .	29th . .	Cyclone, Lat. 13°N., Long. 51°E. Storm lasted from 9 A.M. to 1 P.M.; wind veered from N.-N.-E. to S.-E.; blew with terrific force 1 P.M.	None.
35	1867	...	...	Cyclone passed over Minikoi .	Maldives.
36	1869	June . .	4th to 6th .	Gale from S.-E. at Bombay. .	N. Konkan.
37	1871	January .	15th . .	Cyclone off Ratnagiri . .	N. and S. Konkan.
38	1871	May . .	5th to 7th .	Cyclone in Lat. 16°N. and Long. 58°33′E.	None.
39	1871	June .	29th and 30th	Cyclone in Lat. 16°N., Long. 59°E., strong S.-W. gales between Lat. 6° and 10°N., and Long. 50° and 53°E.	S. Arabian coast.
40	1871	October .	?	Cyclone between Socotra and Bombay. *Serapis* suffered.	S. Arabian coast.
41	1874	March .	?	A W.-N.-W. to N.-W. gale lasting for two days and travelling from entrance Persian Gulf towards Cutch coast.	Sind, Cutch.
42	1879	May . .	21st to 26th .	Cyclone from Bay crossed Peninsula to Karwar, then northward to Bhuj.	N. and S. Konkan and Kattiawar.
43	1880	November	21st to 23rd.	Cyclone from Bay crossed to Calicut, encountered in Arabian Sea in Lat. 17°N., Long. 66°E.	Malabar.
44	1881	May-June .	May 27th to June 3rd.	Violent cyclone, Arabian Sea, moving from east to west.	None.
45	1883	July . .	3rd and 4th	Cyclone from Bay crossed Cutch coast on evening 3rd, felt in Lat. 24°N., Long. 63° 30′E.	Cutch and Kattiawar.
46	1884	October .	16th to 18th.	Cyclone passed from Bay of Bengal to Calicut.	Malabar.
47	1885	May . .	30th to June 3rd.	Aden cyclone travelled from about Long. 62°E. and Lat. 13°N. to Gulf of Aden.	S. Arabian coast.
48	1885	June . .	8th to 13th.	Cyclone, Arabian Sea, travelled from Lat. 15°N., Long. 70°E. to entrance Persian Gulf.	Konkan, Sind and Mekran coasts.
49	1886	May . .	24th to 28th.	Cyclone over centre of Arabian Sea.	None.

No.	Date.			Details of storm.	Coasts affected.
	Year.	Month.	Days.		
50	1886	November	10th to 15th.	Cyclone from Bay crossed Peninsula, the centre when over the Arabian Sea travelling first to N.-W. then to N., and finally to N.-E.	Konkan and Mekran coasts.
51	1887	June .	4th to 13th.	Cyclone, Arabian Sea, began in Lat. 17°N., Long. 72°E., travelled W.-N.-W. to Lat. 19° N., Long. 60°E.	S. Arabian coast.
52	1887	October .	11th to 13th.	Cyclone crossed from Bay to west coast near Goa, passed northward close to coast, then moved north-eastward into Khandeish.	N. and S. Konkan.
53	1888	November .	4th to 10th.	Small cyclone advanced north-eastward from Lat. 15°N. and Long. 68°E. to Kattiawar (*Vaitarna*).	Cutch and Kattiawar coasts.
54	1889	June .	2nd to 8th .	Cyclone travelled northward along west coast.	West coast (whole).

List of Gales in Arabian Sea.

Descriptions of the various Storms.

In the following description of the various storms enumerated in the foregoing list, all the information obtainable has been included. Where this information is extensive it has been set forth in tabular form. In these tables the positions of the vessels are those recorded at noon. The observations of wind, pressure and temperature also refer to noon unless otherwise stated. So far as possible corrections have been obtained for the barometers on board the various ships, and these corrections have been applied to the readings before utilising them for the discussion of the various storms. In the case of the earlier storms, however, no comparison of the barometers with a standard was possible, and hence the readings given by Piddington, Buist, &c., have been inserted in the tables as they stand in the investigations of those authors, a note of interrogation being added to those which the present writer considers untrustworthy. The thermometer readings are those given in the log-books. As, however, there is always a doubt whether the temperatures are the reading of a thermometer attached to the barometer suspended in a cabin or state room or the readings of a thermometer exposed in a cage in the outside air, these observations must be accepted with a certain amount of reservation. In the column of "Weather remarks" readings of the barometer other than those at noon and the general character of the weather during the 24 hours are given.

May 1648. Pl. LVIII.

Storm No. 1.—This storm occurred on the 27th of May in 1648, and was felt from Bombay northward. It was probably a cyclonic storm travelling northward along the west coast, but was, with the then imperfect means of communication, only recorded at Bombay.

May 1762. Pl. LVIII.

Storm No. 2.—This storm occurred in 1762, also in May, and the only report of its existence is from Goa.

April 1779. Pl. LVII.

Storm No. 3.—About the middle of April 1779 a hurricane was felt off Anjengo (Latitude 8° 40′ north, Longitude 76° 45′ east), in which the East India Company's ship *Cruiser* was lost.

April 1782. Pl. LVII.

Storm No. 4.—Three years later, in 1782, and on the 20th and 21st of April, a severe storm passed up the west coast of India. The wind was southerly all along the coast, so that presumably the centre of the cyclone travelled northward parallel to the coast. The gale was most severe in the Gulf of Cambay. Her Majesty's ships *Cuddalore* and *Revenge*, and several other ships, foundered (positions not given), and the *Essex* and *Nancy* were dismasted. In the Gulf of Cambay the storm was accompanied by a dreadful inundation; the storm-wave having apparently continued on a northerly course into the Gulf after the storm itself had curved to north-westward. Strong southerly winds frequently blow in the Gulf after the middle of April, but the heavy storm in April 1782 is apparently without precedent. Several large and small ships were anchored in Surat Roads: some parted their cables and were driven ashore, others rolled away their masts in the heavy sea. Since 1782 no such storm has happened in the Gulf in either April or May.

Gale in Gulf of Cambay.

May 1782. Pl. LVIII.

Storm No. 5.—One month later, on the 20th May 1782, a storm occurred off Calicut.

November 1783. Pl. LXII. Loss of shipping and lives, Bombay.

Storm No. 6.—Between the 3rd and 7th November in 1783 a violent hurricane passed along the west coast, apparently on a curved course. The centre probably reached the coast near Bombay, as the storm was not felt to the northward of that port. There was great loss of shipping and of lives, almost every ship encountering the storm being lost.

November 1799. Pl. LXII. Loss of shipping and lives, Bombay.

Storm No. 7.—Between November 3rd and 7th in 1799 a storm, similar to the above, swept along the west coast from Calicut northward. Her Majesty's ship *Resolution* and the ships *Hercules*, *Hunter*, and about 100 small craft, were wrecked in Bombay Harbour. About 400 lives were lost. At Bombay the wind was first from south-east, and then for some time blew with hurricane force from east. If the shifts of wind occurred in this order, it is probable that the cyclone passed inland immediately to the southward of, or over, Bombay and broke up among the Ghâts.

January 1805. Pl. LV.

Storm No. 8.—A cyclone struck the Ceylon coast at Trincomalee on January 7th, 1805, and passed west-north-west to the Malabar coast.

June 1807. Pl. LIX.

Storm No. 9.—On June 24th, 1807, a furious hurricane occurred off Mangalore. There is no other record of this storm, and it is possible that it was merely a very rough burst of the monsoon.

June 1811, Pl. L.: *Essex* cyclone.

Storm No. 10.—On June 4th and 5th in 1811 there occurred a cyclone in Latitude 16° north and Longitude 70° E. The information respecting this storm is chiefly derived from the log-book of the East India Company's ship *Essex*. On the 3rd of June, at noon, she was in Latitude 16° 38′ N. and Longitude 69° 32′ E., with light

breezes from north and fair weather. After noon there was a high sea breaking in all directions and a freshening north-east wind. At night there was lightning to south-west. *Storm No. 10.*

On the 4th at 1 A.M. the wind was north-north-east, and at 7 A.M. had increased to a hard gale. At noon the *Essex* lay in Latitude 16° 19′ N. and Longitude 70° 12′ E. By midnight the wind was blowing a hurricane from north by east.

On the 5th the wind shifted *suddenly* to north-west, and at 8 A.M. equally suddenly to west-south-west, blowing with hurricane force.

It is plain from this account that the *Essex* was driven round the north-west, west and south-west sides of a cyclone, and probable that the storm was travelling almost due north. The fact of a north-easterly wind and thick hazy weather prevailing at this time of year and in this position is sufficient to show that the ordinary conditions of weather had been seriously disturbed. The following table shows the probable position and motion of the centre of the storm :— Position of centre and rate of motion on each day.

Date.	Position of Centre.		Direction of motion.	Distance travelled since noon of previous day.	Rate per hour.
	Latitude N.	Longitude E.			
1811.	° ′	° ′		Miles.	Miles.
June 3rd.	14—30	70—45	...	...	...
„ 4th.	16—15	70—45	N.	116	4·8
„ 5th	18—20	68—45	N.-N.-W.	181	7·6

Storm No. 11.—About September 25th, 1819, a storm, lasting a day and two nights, was felt on the Cutch and Kattiawar coasts, but it is doubtful if the gale were a true cyclone. September 1819. Pl. LX.

Storm No. 12.—This storm, of which very little is known, crossed the Peninsula from Madras, and on the 8th of May 1820 occasioned a hurricane to the southward of Bombay. May 1820. Pl. LVIII.

Storm No. 13.—On December 17th, 1831, the East India Company's sloop of war *Elphinstone* experienced a heavy gale from south-east, then north-east, and finally east, when 120 miles west of Dwarka. This appears to have been a cyclone, but the direction in which it was travelling is doubtful. It is worthy of notice that on December 6th of the same year a fearfully destructive gale occurred at Pondicherry and Cuddalore. There is no connecting link between these two storms, but that the Dwarka cyclone may have been a continuation of the Cuddalore hurricane is possible. December 1831 Pl. LXIII.

Storm No. 14.—In 1836, on the 8th and 9th of June, a cyclone was encountered in Latitude 23° N. and Longitude 63° E., or at about 100 miles from the coast of Beluchistan, by the cruiser *Ternante*. The cyclone apparently travelled from east-south-east along the coast, and then curved towards north when off the Persian Gulf. June 1836. Pl. LIX.

June 1837. Pl. LIX.

Storm No. 15.—In 1837, on June 15th, a tremendous cyclone swept over Bombay, causing immense destruction of property and shipping. There is no information as to the path of the storm.

October 1842. Pl. LII. *Reference*—Jour. Asiatic Soc., Bengal, Vol. XII, p. 339.

Storm No. 16.—In 1842, at the end of October, a cyclone originated in the Bay of Bengal, crossed the Peninsula, and was felt during the last days of October and first days of November in the Arabian Sea. It is stated to have been experienced as far west as Aden.

The following are the data on which the various positions of the storm have been established :—

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1842.		° ′	° ′				
Oct. 20th.	*Waterloo* .	10—16	92—23	N.-E. 6 .	...	...	Fine.
,, 21st .	*Ditto* . .	11—52	91—16	N.-N.-E. 6 .	...	...	Wind increasing; midnight squally.
,, 22nd	*Ditto* . .	13—27	90—3	N.-N.-E. 8 .	...	...	Heavy gale ; squally.
,, ,, .	*L. Faversham*	12—45	86—5	N.-N.-W. 8 .	2 P.M. 29·70	...	11 P.M. 29·40.
,, ,, .	*A. Metcalfe* .	(?)	(?)	N.-E. . .	Noon 29·70	...	4 P. M. 29·60 ; 8 P. M. 29·40 ; midnight 29·20.
,, ,, .	*London* .	13—50	86—0	N.-E. . .	Noon 29·75	...	.....
,, ,, .	*Sarah* . .	14—52	83—24	N.-E. 6 .	...	...	.....
,, ,, .	*Stalkart* .	12—10	80—33	N.-N.-E. 5 .	...	...	.....
,, ,, .	*Favorite* .	12—12	81—40	N.-E. 5 .	...	...	Threatening ; squally.
,, ,, .	*Whitby* .	14—52	88—0	N.-N.-E. 4 .	29·90	...	Midnight 29·78.
,, 23rd .	*Waterloo* .	14—45	88—55	S.-E. . .	...	...	Variable ; squally.
,, ,, .	*L. Faversham*	12—4	86—22	E.-S.-E. 8 .	...	...	1 A.M. 28·40, N. 12 ; 2-45 A.M. wind lulled, frightful sea, ship rolling ; 3 A. M. wind S. 12 ; 3-30 A.M. bar. 28·30, S. 12.
,, ,, .	*Whitby* .	12—30	86—0	S.-E. 8 .	28·45	...	N.-N.-W. 8, 3 A.M. ; N.-N.-E. 12, 7 A.M.; bar. 27·45, 8 A.M. ; calm 9 A.M. ; wind suddenly S.-W. at 10·30 A.M. ; 1 P.M. barometer rose suddenly.
,, ,, .	*A. Metcalfe* .	12—0	85—30	N. 12 . .	28·50	...	4 A.M., N. 8, 28·70; noon calm for ½ hour, then S. 12 ; 4 P.M. 28·50 ; 8 P.M. 28·80.
,, ,, .	*London* .	12—56	83—55	N.-E. 9 .	29·70	81	6 A.M., N.-E. 8; 8 A.M. N.-E. 9, 29·80.
,, ,, .	*Sarah* . .	14—7	84—24	N.-N.-E. 9 .	29·73	...	Squally.
,, ,, .	*Stalkart* .	11—33	80—58	N. 10 . .	...	...	.....
,, ,, .	*Favorite* .	11—49	83—35	N.-N.-E. 10 .	...	...	.....
,, ,, .	*Elphinstone* .	15—37	81—30	N.-N.-E. to E. 10 . .	29·69	...	.....
,, ,, .	*Amelia Mullholland* .	Madras.		N. 6 . .	29·60	...	.....
,, ,, .	*Lady Clifford*	10—48	(?)	N. 8, 6 .	30·05	...	.....
,, ,, .	Pondicherry .	...	...	. . .	30·00 (uncorrected)	...	.....
,, ,, .	Bangalore .	...	...	. . .	27·162 (uncorrected)	...	.....

Storm No. 16.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1842.		° ′	° ′				
Oct. 23rd.	Ryacottah	...	...	. . .	27·087 (uncorrected)	...	.....
,, ,,	Patchirupam	12—22	79—6	N.-E 6 . .	26·971 (uncorrected)	...	... ..
Oct. 24th.	Bellary	...	...	. . .	28·65 (uncorrected).	...	.....
,, ,,	*Waterloo*	14—40	86—38	S.-E. 5 .	...	...	.....
,, ,,	*Lady Faversham*	13—16	86—35 (?)	S.-S.-E. 5 .	...	...	Fair weather.
,, ,,	*Whitby*	12—16	84—40	S.-E. 6 .	30·15	...	Ditto.
,, ,,	*Ann Metcalfe*	12—6	84—30	S.-S.-E. 5 .	29·50	...	Ditto.
,, ,,	*London*	12—34	83—44	E.-S.-E. 6 .	29·70	...	Ditto.
,, ,,	*Sarah*	13—34	83—53	E.-S.-E. 9 .	29·73	...	Ditto.
,, ,,	*Stalkart*	11—33	81—31	S. 9 . .	...	...	.....
,, ,,	*Favorite*	11—53	83—35	S.-S.-E. 8	...	...	Squally.
,, ,,	Madras	...	...	N.-N.-E. .	29·73	...	.....
,, ,,	*Amelia Mullholland*	12—46	80—38	E. 12 . .	29·30	...	.....
,, ,,	*Repulse*	13—0	80—30	N.-N.-E. 10 .	29·29	...	.....
,, ,,	*Lady Clifford*	11—0	80—10 (?)	W.-S.-W. 10	30·00	...	.....
,, ,,	*General Kyd*	13—0	80—38 (?)	N.-E. 12 .	29·44	...	.....
,, ,,	*Dauntless*	13—0	80—38	N.-N.-E. 12. .	29·40	...	.. ...
,, ,,	Pondicherry	...	...	. . .	29·90	...	6 P.M., bar. 28·65, calm.
,, ,,	Bangalore	...	...	. . .	27·119	...	Wind at height, midnight, 24th to 2 A.M. 25th, direction S.-W.
,, ,,	Ryacottah	...	...	N. 6 . .	27·035	...	.....
,, ,,	Amboor	12—22	79—6	N.-E. . .	28·798	...	Drizzling rain.
,, ,,	Bellary	15—6	77—5	N.-E. to N.-W.	...	...	.....
,, ,,	Tellicherry	...	...	Light land and sea breezes.	...	...	Fine.
,, 25th	*London*	13—20	84—10	S.-E. . .	30·05	82	Fine.
,, ,,	*Symmetry*	12—42	82—42	S. . .	...	...	Fine.
,, ,,	*Neptune*	12—43	80—17	S. light .	...	...	.....
,, ,,	*Lady Clifford*	11—9	80—20	S. . . .	...	...	Fine.
,, ,,	*Dauntless*	13—0	80—30	S.-E . .	29·50	84	
,, ,,	Bangalore	...	...	. . .	26·972	...	Wind N. 10 A.M., S. at 1 P.M.
,, ,,	Ryacottah	...	...	. . .	26·961	...	.....
,, ,,	Mangalore	...	...	. . .	...	...	Light showers with strong gusts of wind from N.-W.
,, ,,	Amboor	12—22	79—6	Calms and light wind.	28·912	75	1 A.M. gale at height from N.; 10 A.M. 29·864, wind S.-E.
,, ,,	Bellary	...	...	Wind N. to N.-E. and N.-W.; then for days from S.-E.	...	...	.....
,, ,,	Bombay	...	...	. . .	29·699	...	.....
,, 26th	Bangalore	...	...	. . .	27·033	...	.....
,, ,,	Ryacottah	...	...	. . .	27·029	...	.....
,, ,,	Mangalore	...	...	. . .	...	...	Cloudy light showers, strong S. winds.
,, ,,	Amboor	...	...	. . .	28·914	77	Cloudy light wind.
,, ,,	Tellicherry	...	...	Strong breezes S.-E. to S., and S.-W. at night.	...	...	Cloudy slight rain.

	Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
Storm No. 16.	1842.		° ′	° ′				
	Oct. 20th.	Bombay	...	...	. . .	29·643	...	.....
	,, ,,	*Futtay Salaam.*	10—16	68—54	W.-N.-W. 9	...	...	A. M. heavy N.-W. swell; midnight S.-W. wind.
	,, 27th	Bangalore	...	...	. . .	27·052	...	.....
	,, ,,	Mangalore	...	...	. . .	...	...	Cloudy light showers, strong S. wind.
	,, ,,	Bellary	...	...	S.-E.	28·55	...	.....
	,, ,,	Tellicherry	...	...	. . .	...	...	Cloudy, drizzling rain, and lightning.
	,, ,,	Bombay	...	...	. . .	29·626	...	.....
	,, ,,	*Lucy Wright*	13—2	71—39	Hurricane	...	...	.....
	,, ,,	*Futtay Salaam.*	11—55	69—9	S.-E. hurricane.	...	...	.....
	,, ,,	*Seaton*	14—0	55—0	N. 4	...	...	.....
	,, 28th	Bangalore	...	...	. . .	27·158	...	.....
	,, ,,	Ryacottah	...	...	. . .	27·039	...	.....
	,, ,,	Tellicherry	...	...	Fresh S.-W. wind.	...	...	Cloudy.
	,, ,,	Bombay	...	...	. . .	29·665	...	.....
	,, ,,	*Higginson*	18—0	70—20	W. to S. 10	28·50	...	Thunder, lightning, and heavy rain.
	,, ,,	*Futtay Salaam.*	13—31	68—9	. . .	...	...	Violent squalls.
	,, ,,	*Seaton*	14—0	56—36	N. 4	...	...	.....
	,, 29th	Tellicherry	...	..	W. 5	...	...	Fine.
	,, ,,	Bombay	...	...	. . .	29·732	...	.....
	,, ,,	*Seaton*	14—0	58—12	N. 4	...	...	.....
	,, ,,	*Chieftain*	7—52	55—54	Light airs	...	...	Sea calm.
	,, 30th	*Seaton*	14—0	59—48	N.-N.-W. 6	29·7	...	Bar falling.
	,, ,,	*Chieftain*	8—26	56—46	E.-N.-E. light	...	...	Cloudy.
	,, 31st	*Seaton*	14—0	61—0	Hurricane from N.-N.-W.	27·6	...	.....
	,, ,,	*Chieftain*	9—40	57—6	N.-N.-W.—N.-W. light.	...	...	Cloudy.
	Nov. 1st	*Seaton*	12—36	60—38	E.-S.-E.—S.-E. hurricane.	28·0	...	.....
	,, ,,	*Chieftain*	11—12	57—15	N.-N.-W. 5	...	...	Cloudy.
	,, 2nd	*Chieftain*	13—5	57—15	W.—W.-S.-W.	...	...	Heavy sea; equally.

The first indication of this hurricane is afforded by the log of the *Waterloo*. This vessel when near the southern extremity of the Andamans on the 20th October 1842, and when there was no sign of unsettled weather, had fresh north-north-east breezes. During the 21st and 22nd the *Waterloo* proceeded westward, and on the latter date experienced heavy gales from north-east. The position of the *Waterloo* at noon on the 22nd was Latitude 13° 27′ N. and Longitude 90° 3′ E., and the centre of the storm was about 120 miles to the south-east of this position. At 2-45 A.M. of the 23rd the calm centre of the hurricane passed over the *Lady Faversham*, which ship was approximately in Latitude 12° 17′ N. and Longitude 86° 13′ E. At noon on the same date (23rd) the calm centre passed over the *Ann Metcalfe* in Latitude 12° 0′ N. and Longitude 85° 30′ E., so that the direction of movement of the storm was a little to the south of west. At noon on the 24th the storm centre was probably in Latitude 12° 0′ N. and Longitude 81° 0′ E., the storm having advanced due westward. The *Amelia Mullholland* in Latitude 12° 46′ N. and Longitude 80°

October 21st and 22nd.

October 23rd.

October 24th.

38′ E. at noon on this day had an easterly hurricane, and the *Lady Clifford* in Latitude 11° 0′ N. and Longitude 80° 10′ E. had a westerly hurricane, so that the storm centre lay between those two vessels and approximately in the position given. At 20 minutes past five on the 24th, the calm, indicating the passage of the storm centre, occurred on the Coromandel coast just to the north of Pondicherry. In crossing the Peninsula the rate of movement of the storm slackened somewhat, and at noon on the 25th it is calculated that the centre lay in about Latitude 10° 45′ N. and Longitude 76° 40′ E. The direction of movement of the storm was during the 24 hours—noon 24th to noon 25th—nearly south-westward. At 10 P. M. on the 25th the *Seaforth* encountered the cyclone when about 60 miles to the west of Cochin, but there is no information as to the wind direction during the storm. For the 26th there is no information of stormy weather beyond that supplied by the *Futtay Salaam*, which vessel, in Latitude 10° 16′ N. and Longitude 68° 54′ E., experienced a west-north-west heavy gale. By estimation the centre on this day is placed in Latitude 10° 35′ N. and Longitude 72° 15′ E, so that the direction of motion was a little to the north of west. On the 27th two vessels report hurricanes—one the *Lucy Wright* in latitude 13° 2′ N. and Longitude 71° 39′ E., and the second, the *Futtay Salaam*, in Latitude 11° 55′ N. and Longitude 69° 9′ E. The latter had a south-east hurricane at noon, and the former was totally dismasted, but from what direction the wind blew is not mentioned. The vessel must, however, have been about 250 miles away from the centre of disturbance, which on this day is placed in Latitude 11° 40′ N. and Longitude 67° 50′ E. On the 28th the *Futtay Salaam*, which was proceeding northward, passed out of the direct influence of the cyclone and only experienced violent squalls. The only ship recording a gale on this day was the *Higginson*, which experienced a very heavy gale from west to south. The position of this ship on this day was Latitude 18° 0′ N. and Longitude 70° 20′ E., and it is almost impossible to suppose that this gale had any direct connection with the cyclone, which has been traced to Latitude 13° N. Consequently, on this day the position of the centre can only be fixed approximately, and it is placed in Latitude 12° 15′ N. and Longitude 66° 20′ E. It is important to note that on this day the *Seaton*, in Latitude 14° 0′ N. and Longitude 56° 36′ E., or about 600 miles west of the storm centre, had a moderate northerly wind and fair weather. By noon on the 29th the *Seaton* had advanced eastward to Latitude 14° 0′ N. and Longitude 58° 12′ E., while the storm by estimation had advanced westward to Latitude 12° 30′ N. and Longitude 64° 50′ E., so that the distance between the ship and the storm had been reduced to about 400 miles. The wind on board the *Seaton* was still only moderate from north, while the *Chieftain*, which was about 150 miles to the south-west of the

Storm No. 16.

October 25th.

October 26th.

October 27th.

October 28th.

October 29th.

Storm No. 16. October 30th. *Seaton*, had light airs and a calm sea. The *Seaton* had, by noon on the 30th, advanced eastward as far as Longitude 59° 48′ E., and was still in Latitude 14° N., while the *Chieftain* had advanced north-eastward as far as Latitude 8° 26′ N. and Longitude 56° 46′ E., while the storm centre, still by estimation, was in Latitude 12° 45′ N. and Longitude 63° 20′ E. There was thus a distance of about 200 miles between the *Seaton* and the storm centre. On board this vessel the wind had drawn into north-north-west, and freshened with a falling barometer, but there was no other indication of the neighbourhood of a severe cyclone, and in the evening there was neither cloud nor fog on the horizon. After noon on the 30th the wind gradually increased, a head sea set in and the barometer continued to fall.

October 31st During the forenoon of the 31st, as the wind continued to rise, the order was given to take in all sail, but before this could be accomplished, the hurricane burst over the ship from north-north-west with great suddenness, and during the afternoon the ship was completely dismasted. The centre of the storm on noon of this day is calculated to have been in Latitude 12° 45′ N. and Longitude 61° 45′ E., or about 100 miles to the south-east of the *Seaton*. The *Chieftain* was in Latitude 9° 40′ N. and Longitude 57° 6′ E., and recorded a light north-west wind and cloudy weather.

November 1st. Early in the morning of the 1st the wind on board the *Seaton* shifted from north to east-south-east, and blew with redoubled fury. This shift of wind showed that the centre had continued its westerly advance, but had passed to the southward of the ship, and the centre on this day is placed in Latitude 12° 35′ N. and Longitude 59° 30′ E. The *Chieftain* never encountered the hurricane, but on

November 2nd. the 2nd, when in Latitude 13° N. and Longitude 57° 15′ E., she had heavy rain, with the wind shifting from west by north through west-south-west to south-west, and a very heavy sea from north by east or north-east was experienced. These conditions were evidently due to her nearness to the hurricane, though the storm never actually struck her.

The disturbance thus followed a slightly curved westerly course. The rate of motion was, between the 25th and 27th, rapid, averaging 12¾ miles per hour, but after noon of the 27th the velocity decreased, and between that hour and noon on the 31st was only 4 miles per hour. Between the 31st October and 1st November the velocity again increased and amounted to 6 miles per hour.

It is necessary to discuss in further detail the observations given above, in order to determine, by comparison with other storms of the same class, whether any general characteristics exist which may be confidently expected to prevail whenever a storm of this description advances into the Arabian Sea.

Originated in Bay of Bengal. This storm was an example of that interesting class of cyclones which, after developing in the Bay of Bengal, pass right across the

Storm No. 16.

Peninsula and continue their course in the Arabian Sea. The information is much more complete for the Bay of Bengal portion of the path than for the subsequent portion after the Madras coast had been left behind. According to Piddington, the centre crossed the Madras coast a little to the north of Pondicherry at 5 P.M. on the 24th of October, and the Amboor valley (Latitude 12° 22′ N. and Longitude 79° 6′ E.) at 1 A.M. on the 25th, and reached the Palghatcherry pass at noon on the 25th, thus taking about 20 hours to cross the Peninsula, a distance of 350 miles, or at a rate of nearly 20 miles per hour.

Passed through Palghutcherry pass.

The first subject for investigation is the condition existing on the west coast of India during the passage of the storm. We know that the storm crossed the Madras coast at 5 P.M. on the 24th of October, and passed out into the Arabian Sea between 1 and 2 P.M. on the 25th. The following is the record from Mangalore :—

Weather prevailing on west coast during passage of storm.

24th October 1842	Heavy rain.
25th „ „	Light showers, strong gusts from north-west.
26th „ „	Cloudy, light showers, strong southerly winds.
27th „ „	Ditto ditto ditto.

Weather prevailing on west coast during passage of storm.

At the French settlement of Mahé, which is only 60 miles north of the track as estimated by Piddington, " no person recollects any particularly bad weather or such signs of it as might have indicated that a storm was raging elsewhere ; the surf was rather high." The Sub-Collector of Malabar, who was near Mount Dilly, 90 miles from the estimated track, " noticed that the small harbour was most unusually filled with coasting craft, and understood they had sought refuge from bad weather at sea. The sky at the time looked very stormy, and the Collector was prevented from crossing the mouth of the Cavery river by the extreme violence of the surf ; but no gale was experienced."

These remarks show that on the Malabar coast the effects of the storm were very little felt, and go to prove that a severe storm may cross the Western Ghâts, and hardly influence, in any appreciable degree, the weather prevailing along the narrow belt of land interfering between the mountains and the sea, or over the sea itself in the immediate neighbourhood of the coast. The change in the wind at Mangalore from north-west to south shows that the cyclonic influence was felt there, but only in a modified form.

Passage over Arabian Sea.

Over the Arabian Sea itself conditions are somewhat obscure. The logs of the *Futtay Salaam* and the *Seaton* enable the course of the main storm to be laid down probably fairly exactly, but the gale of the *Higginson*, and perhaps that of the *Lucy Wright*, can hardly be attributed to the main cyclone. The *Lucy Wright* was dismasted in Latitude 13° 2′ N. and Longitude 71° 39′ E. on the 27th, while the centre of the storm on that day was calculated to be in Latitude 11° 40′ N. and Longitude 67° 50′ E., or about 260 miles away. On the 28th the *Higginson*, in Latitude 18° N. and Longitude 70° 20′ E., had a very

Storm No. 16.

heavy gale from west to south. On this day she was, by calculation, 495 miles away from the storm centre, so that apart from the wind's direction it is most improbable that she was affected by the main depression.

Disturbances subsidiary to main storm.

It therefore appears that in crossing the Western Ghâts the original storm was much broken, and that on the disturbance again reaching the sea-level it consisted, not of a single storm, but of a main storm with some—perhaps several—smaller storms, and that one of these passed almost due northward towards Kattiawar. This method of storm-generation by fission is a very important point to be borne in mind in dealing with the storm-phenomena of this sea.

As regards the close of the existence of this storm there is some doubt.

Conclusion of storm.

The log of the *Seaton* enables the position of the centre on the 31st October and 1st November to be decided comparatively exactly, but after the 1st there exists much uncertainty. In the first place, the *Chieftain*, on the 2nd, at noon, was exactly in the position which, by estimation, would have been occupied by the cyclone had the centre continued to travel in the same direction and with the same velocity it had previously possessed. Now, this ship only recorded winds of force 5 from west-south-west, and practically never felt the storm at all. Opposed to this is the evidence that at Aden, during the first week of November, the weather was stormy with very heavy seas from the eastward; that fifty-one ships were lost at this time between the Gulf of Maseera and Ras-el-had, ten between the Gulf of Maseera and Aden, and nine to the southward of Cape Guardafui. These indications of stormy weather point to a further advance of the cyclone, but in what direction it is difficult to say.

Wrecks on the African and South Arabian coasts.

The "eye of the storm."

The *Seaton* passed close to the centre of the storm at daylight on November 1st, and reports that the rain fell in torrents, the lightning was awful and the clouds intensely dark and resting on the surface of the sea. In the zenith there was an obscure circle of about 10° to 12° of imperfect light.

Position of centre and rate of motion on each day.

The following are the approximate positions of the centre on each day of the storm's existence in the Arabian Sea:—

Date.	Position of Centre.		Direction of motion.	Distance travelled from noon of previous day.	Rate per hour.
	Latitude N.	Longitude E.			
1842.	° ′	° ′		Miles.	Miles.
Oct. 25th	10—45	76—40	...	...	...
26th	10—35	72—15	W.	283	12
27th	11—40	67—50	W by N.	305	13
28th	12—15	66—20	W. by N.	102	4
29th	12—30	64—50	W. by N.	102	4
30th	12—45	63—20	W.	102	4
31st	12—45	61—45	W.	102	4
Nov. 1st	12—35	59—30	W. by S.	152	6

Storm No. 17.—At the close of November 1845 a cyclonic storm was formed over the Bay of Bengal, which passed across the Indian Peninsula and travelled north-westward into the Arabian Sea. The details of this storm, like those of its predecessor, are found in the Journal of the Asiatic Society of Bengal. The following data give the information on which the track of the storm has been laid down :—

Storm No. 17. November—December 1845. *Reference*—Jour., Asiatic Soc., Bengal, Vol. XIV, Part II, p. 878.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1845.		° ′	° ′				*Storm No. 17.*
Nov. 29th	*Caledonia*	6—50	88—30	S. to S.-E. 4	29·70	...	Rain.
,, ,,	*Alibi*	9—8	91—0	E.-N.-E. 8	29·45	...	Squally.
,, ,,	*Juliana*	8—54	87—28	N.-N.-E. 12	...	...	.....
,, ,,	*F. Wickliffe*	5—0	86—0	W.-N.-W. 6	...	...	.....
,, ,,	*Frances*	6—4	82—0	. . .	.	...	.....
,, ,,	Cochin	...	...	E. . .	30·232	81	.....
,, ,,	Trevandrum	...	...	. . .	29·930	82	Previous to noon heavy gale from S. to S.-E., and after 6 P.M. Southerly gale.
,, 30th	*Caledonia*	7—0	85—50	S.-W. light	29·35	...	.....
,, ,,	*Alibi*	11—50	89—32	N.-E. 6 to 8	...	...	Squally.
,, ,,	*Juliana*	9—34	86—5	E.-S.-E. gale	...	...	.....
,, ,,	*Frances*	7—42	86—9	W.-N.-W. to S.-W. 10	...	...	Squally.
,, ,,	*Morley*	9—50	87—10	S.-S.-W. 8	29·30	...	.....
,, ,,	*F. Wickliffe*	5—43	86—15	W. to N.-W. 6	...	...	.....
,, ,,	*W. Abram*	4—36	90—10	S. 4 . .	...	80	Cloudy.
,, ,,	Trincomalee	...	...	N.-E. 5	29·82	82	.....
,, ,,	Cochin	...	...	E. . .	30·190	81	.....
,, ,,	Trevandrum	...	...	. . .	29·864	82	.....
Dec. 1st	*Caledonia*	8—36 (?)	85—50	S.-E. to S. 8	29·60	...	.....
,, ,,	*Alibi*	10—53	84—53	E.-N.-E. 6	...	...	.....
,, ,,	*Frances*	9—13	85—41	S.-W. 6	...	...	.....
,, ,,	*F. Wickliffe*	7—9	85—42	S.-S.-E. 5	29·80	...	.....
,, ,,	*Hindoostan*	6—50	82—10	N.-N.-E. 8	29·69	...	Squally.
,, ,,	*Carnatic*	4—25	78—43	N. 4 . .	29·70	...	Rain.
,, ,,	*Bolton*	4—40	77—37	N.-N.-E. 5	29·90	83	.....
,, ,,	Trincomalee	...	...	N.-E. 5	29·74	79	.....
,, ,,	Palamcottah	...	...	N. 4 . .	29·856	78	.....
,, ,,	Cochin	...	...	E. 3 . .	30·200	80	.....
,, ,,	Trevandrum	...	... (?)	. . .	29·844	81	.....
,, ,,	*C. Forbes*	7—52	77—0	E.-N.-E. 3	...	...	.....
,, ,,	*Monarch*	11—56	88—14	N.-E. . .	29·78	...	Fine.
,, 2nd	*Hindoostan*	8—41	82—20	E.-S.-E. 10	29·64	...	Gale E. and N.-E.; at midnight wind suddenly lulled and shifted to S., blowing hurricane at 1 A.M., after 2nd.
,, ,,	*Carnatic*	5—21	79—33	N.-W. 6	29·66	81	.....
,, ,,	*Bolton*	5—50	77—24	N.-W. .	29·80	84	Rain; squally.
,, ,,	Trincomalee	...	...	S.-E. 6	29·71	79	2 A.M. E. 9, violent gale; squally.
,, ,,	*Frances*	11—39	81—30	S.-E. 8	..	...	.....
,, ,,	Batticaloa	...	...	N.-W., then S.-E.	...	...	N.-W. gale midnight 1st to 2 A.M. 2nd; 2-30 A.M. S.-E. terrific gale.
,, ,,	Palamcottah	...	...	. . .	29·88	79	11 P.M. violent gale from S.-E.
,, ,,	Cochin	...	..	E. ..	30·144	81	.....
,, ,,	Trevandrum	...	...	. . .	29·960	82	Three inches rain.

	Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
Storm No. 17.	1845.		° ′	° ′				
	Dec. 2nd.	*Faise*	8—10	78—0	W.-N.-W. 6.	29·95	...	Midnight violent westerly squalls 29·50. Rain.
	,, ,, .	*Rohabarry*						
	,, ,, .	*C. Forbes* .	8—48	76—30 (?)	Calm . .	...	...	9 P. M. squally 29·80; 10 P. M. squally 29·75; midnight N.-W. 10, 29·62.
	,, ,, .	*Recovery* .	12—29	74—30 (?)	Light breezes	29·76	...	.....
	,, ,, .	*Monarch* .	11—55	69—5	N.-E. 8 .	30·00	...	.....
	,, 3rd .	*Carnatic* .	6—46	78—29	S.-W. . .	29·80	84	.....
	,, ,, .	*Bolton* . .	7—17	77—10	W., then N. .	29·60	...	Severe squalls, torrential rain, then calm.
	,, ,, .	Trincomallee .	...	...	N.-N.-E. 2 .	29·84	81	.....
	,, ,, .	Palamcottah .	...	...	S.-E. 6. .	29·866	78	6 A. M. hurricane abated, fresh S.-E. breeze.
	,, ,, .	Cochin .	...	...	S. to S.-W. .	30·160	79	6 A. M., N.-E. 10, 29·964; 7 A.M., E. by S.; 8 A.M., S.-E. 6; 9 A. M., S.-E. 6.
	,, ,, .	Trevandrum .	...	...	. . .	29·99	80	1 A. M. violent gale; 3 A.M. to 3-30 A.M., calm; then violent gale again.
	,, 3rd .	Quilon . .	...	...	...	...	...	Gale 10 P. M. 2nd, to 7 A.M. 3rd.
	,, ,, .	Alipi . .	...	...	...	...	...	Hurricane at daylight, 3rd.
	,, ,, .	Cannanore .	...	...	...	...	...	Gale 8 A.M. to 1 P.M., N.-E., E. and S.-E.
	,, ,, .	*Faise* .	8—0	77—30	Calm . .	? 29·50	...	.....
	,, ,, .	*Rohabarry*						
	,, ,, .	*C. Forbes* .	8—58	76—30	S.-W. to S. .	29·86	...	2 A.M. N.-W. 10; 4 A.M., W. 10, 29·50; daylight S.-W., 29·70.
	,, ,, .	*Recovery* .	12—57	74—20	N.-E. 6 .	29·67	...	3 P.M. S.-S.-E. in squalls.
	,, ,, .	*J. Brown* .	8—58	73—29	S.-W. 6 .	29·80	87	.....
	,, ,, .	*Monarch* .	12—16	70—29	N. . .	29·42	...	10 P.M. 29·30 N. 8.
	,, ,, .	*Euphrates* .	14—35	69—58	N.-N.-E. 6 .	...	...	.....
	,, 4th .	*Bolton* . .	7—8	77—42	Calm . .	29·80	82	Fine.
	,, ,, .	Palamcottah .	...	...	S. 5 . .	29·95	79	Clear.
	,, ,, .	Cochin .	...	...	S. 5 . .	30·286?	81	.....
	,, ,, .	Trevandrum .	...	... ?		29·928	83	.....
	,, ,, .	*Recovery* .	14—53	74—10	S.-S.-W. 6 .	...	...	.....
	,, ,, .	*Charlotte* .	11—24	76—0	N. 6 . .	...	...	3 P.M. E. 8; 10 P.M. S.-E. 6.
	,, ,, .	*M. of Douglas*	15—43	73—27	N.-E. 4 to 5 .	...	...	.....
	,, ,, .	*Rajasthan* .	9—55	69—0	N.-N.-W. 6 . .	29·85	83	4 P.M. 29·70 N.-N.-W. 8.
	,, ,, .	*Star* . .	8—41	66—43	N.-N.-W. 5 .	...	81	.....
	,, ,, .	*Monarch* .	13—40	69—6	N.-E. 10 .	29·90	...	.....
	,, ,, .	*Euphrates* .	15—16	71—28	E. . .	29·85	...	3 A.M., hard squall from E.
	,, 5th .	Palamcottah .	...	...	N. 4 . .	29·87	78	Clear.
	,, ,, .	Cochin .	...	...	S. 4 . .	30·218?	82	.....
	,, ,, .	Trevandrum .	...	...	...	29·854	81	.....
	,, ,, .	*Recovery* .	16—40	73—20	Light winds .	29·66	...	.....
	,, ,, .	*Charlotte* .	15—11	74—10	S.-E. 5 . .	...	...	.....
	,, ,, .	*Mary Anne* .	8—7	71—15	N.-N.-W. 6 .	29·45	83	.....
	,, ,, .	*Rajasthan* .	11—42	71—5	W.-S.-W. 10	29·85	...	6 A.M. N.-W. 10; noon, wind shifted to W.-S.-W.; 4 P.M. 29·32.
	,, ,, .	*Star* . .	10—41	68—39	N.-N.-W. 8 .	...	81	A M. N.-W. 6; P.M. N.-W., to N. 10.
	,, ,, .	*Monarch* .	13—20	70—20	N.-E. 10 .	29·31	...	N.-E., hurricane to 8 A.M.

Storm No. 17.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
		° ′	° ′				
1845.							
Dec. 6th .	Cochin .	...	...	S. 5 . .	30·17	80	.....
,, ,, .	Trevandrum .	...	...	...	29·822	81	.....
,, ,, .	*Mary Anne* .	9—54	71—16	West .. .	29·40	82	5 P.M. 29·35; 7 P.M. southerly wind.
,, ,, .	*Rajasthan* .	12—32	71—43	S.-E. 8 . .	29·70	..	.....
,, ,, .	*Star* . .	12—6	71—24	N.-N.-E. 8 .	...	76	.....
,, ,, .	*Monarch* .	13—50	70—30	N.-E. 9 .	29·47	..	P.M. wind veering to S.-E.

Crossing Indian Peninsula.

In crossing the Indian Peninsula and Ceylon the same uncertainty exists as was noticeable in the case of the former storm. The log of the Peninsular and Oriental steamer *Hindustan*, which steamed right through the storm, enables the centre to be placed with certainty close to the east coast of Ceylon at 1 A.M. on the 2nd, and by noon on the 2nd the centre was apparently over the Gulf of Manaar. In the evening of that day the *Florist* was lost at Tuticorin during a south-east gale. The storm apparently occupied 15 hours in passing from the Gulf of Manaar to Trevandrum, as the lull due to the passage of the centre occurred in the latter situation at 3 A.M. on the 3rd. For the 3rd and 4th there is no definite information as to the existence of a storm centre, but after noon on the 4th the logs of ships clearly indicate the presence of a cyclone, as well as the position of the centre, on each day, though it is doubtful if it was the same storm as that which crossed the Peninsula. It is important to notice, with regard to the passage of the storm from the Peninsula into the Arabian Sea, that the *Charles Forbes*, only a few miles from the coast sailing off Quilon early on the 3rd, had a westerly gale, and at 8 A.M. a southerly gale, showing that at this distance from the coast the cyclonic movement was quite developed.

Passage over Arabian Sea.

Weather prevailing on west coast during passage of storm.

The following quotations from records kept at the west coast stations show that the gale was distinctly felt at these stations, and that the directions were cyclonic. These records will be found important when coming to the discussion on the passage of the Peninsula by storms:—

Trevandrum.—The wind appears to have blown very strongly at 1 A.M. of the 3rd, and a violent gale lasted from 2-30 A.M. to 3 A.M. The wind abated from 3 A.M. to 3-30 A.M., when the gale recommenced with greater violence than ever, and continued till about daybreak. Three inches of rain fell during the 3rd.

It is evident therefore that the centre of the storm passed over Trevandrum, and that all the usual phenomena, including the calm areas, were experienced.

Quilon.—The Master Attendant writes: "The gale commenced at 10 P.M. of the 2nd and continued till 7 A.M., 3rd" (no direction of wind is given).

Storm No. 17.

Allepy.—The Master Attendant writes: "A gale of wind with rain commenced about midnight, 2nd, and continued till daylight, 3rd, when it blew a hurricane."

Cannanore.—The gale commenced at 8 A.M., 3rd, and lasted till 1 P.M., blowing at first from north-east and east, and afterwards from south-east and south-south-west.

Cochin.—At 6-30 A.M. on the 3rd there was a violent gale from north-east. At 6-45 A.M. the gale was still from north-east and increasing; at 7 o'clock the wind was moderating and more easterly. At 7-30 A.M. there was a strong gale from south-east, and with this direction the wind fell off. About one inch of rain fell between midnight of the 2nd and noon of the 3rd, and the barometer read as follows:—

Hour	4-30 P.M.,	2nd December	30·050°
,,	6-30 A.M.,	3rd ,,	29·980
,,	6-45 ,,	,, ,,	29·964
,,	7-0 ,,	,, ,,	29·980
,,	7-15 ,,	,, ,,	30·000

These details will be found important in discussing the passage of these storms across the Ghâts. It is important to remember that in the case of these stations there is a large surface of flat land intervening between them and the Ghâts, and that the mountains in Travancore are in some cases 8,000 feet above mean sea-level. Hence this geographical difference must be borne in mind in comparing the difference in the distinctness of the cyclonic indications in this region, as compared with stations lying further to the northward under similar conditions of stormy weather.

Passage over Arabian Sea December 3rd.

These extracts show that the storm centre left the west coast between 3 A.M. and 7 A.M. on the morning of the 3rd. From midnight on the 2nd till 2 A.M. on the 3rd the *Charles Forbes* had a north-westerly hurricane. This ship was during this period in about Latitude 8° 48′ N. and Longitude 76° 30′ E., and continued in about the same position till daybreak, when the wind shifted to south-west and south, and the barometer rose. Consequently, the storm passed from east to west to the northward of this ship at about daylight on the 3rd. The subsequent information as to this storm is somewhat obscure. The *John Brown*, in Latitude 8° 58′ N. and Longitude 73° 29′ E., had a fresh south-westerly wind on this day, but there is no trace of a storm in her log, and it appears probable that the centre marked on this date is the commencement of a new storm, rather than a continuation of that which crossed the Peninsula between noon on the 2nd and daylight on the 3rd. The course and distance given in the concluding table iu the next page have consequently been queried. At noon on the 4th there was still no trace of a definite centre, but the winds of the *Rajasthan*, in Latitude 9° 55′ N. and Longitude 69° 0′ E.; of the *Star*, in Latitude 8° 41′ N. and Longitude 66° 43′ E.

December 4th.

Storm No. 17.

of the *Monarch* in Latitude 13° 40′ N. and Longitude 69° 6′ E., and of the *Euphrates*, in Latitude 15° 16′ N. and Longitude 71° 28′ E., show a definite cyclonic circulation around a centre which is approximately that given as the centre of the storm on this day. After noon on this day (4th), the *Rajasthan*, which was advancing north-eastward, experienced a sudden fall of the barometer and north-north-westerly gales. On the 5th a distinct storm centre is traceable. On board the *Rajasthan* at 6 A.M. there was a hard north-westerly gale, with a high pyramidal sea, and at noon, when the ship was in Latitude 11° 42′ N. and Longitude 71° 5′ E., the wind shifted suddenly to west-south-west and the gale took off. At this time, then, the centre lay to the north-north-east of this ship, and the storm was travelling north-westward. On the 6th the wind on board the *Rajasthan* was blowing a south-easterly gale, but after noon both the wind and sea were going down. The position of the centre on this day (6th) is determined by these observations, and by those made on the *Monarch*, which, in Latitude 13° 50′ N. and Longitude 70° 30′ E., had north-easterly gales veering to south-east, and the centre is placed in Latitude 13° 30′ N. and Longitude 71° 0′ E. The difficulties in connection with the localising of this gale are increased by the doubtful observations of position made on board the *Monarch*. This vessel during December 1st, 2nd and 3rd was travelling eastward directly towards the ultimate track of the storm. At noon on the 3rd, when in Latitude 12° 16′ N. and Longitude 70° 29′ E., she had a northerly wind, which subsequently increased to a gale, while at noon on the 4th her position is given as Latitude 13° 40′ N. and Longitude 69° 6′ E., so that during the twenty-four hours noon 3rd to noon 4th, despite the northerly wind, she is shown as having travelled about 150 miles to the northward. During the 4th the ship experienced the full force of the hurricane, and passed around the centre, the wind commencing from north-north-east and shifting round through north, north-west and south-west to south. It appears most probable that a mistake of 2° was made in the computations, and that the *Monarch* at noon on the 4th was in Latitude 11° 40′ N.

December 5th.

December 6th.

As mentioned above, the information regarding the storm is not clear. It is probable that the storm which crossed the Malabar coast at daybreak on the 3rd, and affected the *Charles Forbes* off Cochin, broke up, as there is no definite record of it at noon either on the 3rd or 4th. It is also probable that the storm which was experienced by the *Rajasthan* and the *Monarch* was a storm formed in about Latitude 11° N. and Longitude 72° E., but whether it was wholly initiated in this position, or whether the rudiments of a cyclone advanced to this position from the eastward, the observations do not show.

An important point to be noticed is the low latitude in which the storm originated and travelled during the early part of its course. The centre of the hurricane was first observed in Lat. 7° N. and Long.

Storm No. 17.

85°50′ E., and from this point it travelled on a west-north-west course to the coast of Ceylon, crossed that island between the 1st and 2nd, and appeared over the extreme south of the Indian Peninsula early on the morning of the 2nd.

Position of centre, and rate of motion on each day.

The following were the approximate positions of the centre :—

Date.	Position of Centre.		Direction of motion.	Distance travelled since noon of previous day.	Rate per hour.
	Latitude N.	Longitude E.			
1045.	° ′	° ′		Miles.	Miles.
Dec. 2nd .	8—50	78—30	...	...	...
„ 3rd .	10—20	73—30	W. by N.	(P) 363	(P) 15
„ 4th .	11—20	72—15	N.-W.	109	4½
„ 5th .	12—20	71—15	N.-W.	109	4½
„ 6th .	13—30	71— 0	N. by W	80	3⅓

Track.

The track was thus first west-north-west, then north-west, and finally nearly north ; while the rate per hour between noon of the 2nd and 3rd was 15 miles, and between noon of the 3rd and the 6th only 4 miles per hour.

Storm No. 18. November 1846. Pl. LXII.

Storm No. 18.—A cyclone crossed on November 25th and 26th 1846 from Madras to the Malabar coast. There is no other information of this storm.

Storm No. 19. April 1847 Pl. XLVIII.

Submergence of Laccadive Islands : 1,000 people perished.

Storm No. 19.—In the month of April 1847 a very severe hurricane was experienced on the Malabar and Bombay coasts. As regards loss of life, it was most disastrous, for not only was there great loss in connection with the vessels involved in the hurricane, but the storm-wave accompanying the cyclone swept over several of the Laccadive Islands, and over 1,000 people are supposed to have perished. As in the case of the two preceding storms, the whole details of the present cyclone have been worked out by Piddington, and will be found in the Journal of the Asiatic Society of Bengal. The following are the data on which the position of the centre on each day has been determined :—

Reference—Journal, Asiatic Society, Bengal, Vol XVII, Part I, p. 27.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer	Thermometer.	Weather Remarks.
1847.		° ′	° ′				
April 13th	*E. London*	7—21	73—34	W.-N.-W.	29·80	...	2 P.M. 29·74; 6 P.M. 29·70 ; 10 P.M. 29·68, squally.
„ 14th	*E. London*	7—39	75—4	N.-W. to W.-N.-W. 10.	29·50	...	4 A.M. hurricane from N.-W.; 8 P.M. W.-S.-W. 11.
„ „ .	*Buckinghamshire.*	8—18	72—56	N. . .	29·85	...	1 P.M. 29·72 ; 4 P.M. 29·70 ; 8 P.M. 29·70 ; midnight N.-E. 8, squally.
„ „ .	*Atiat Rohoman.*	9—29	76—18	E.-S.-E. 5 .	...	...	Fine weather.

Storm No. 19.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1847.		° ′	° ′				
April 15th	*E. London*	8—6	76—10	W.-S.-W. 9	29·50	...	4 A.M. 29·56; 10 A.M. 29·50; midnight 29·64, wind S.-W., squally.
,, ,, .	*Buckingham shire.*	9—1	73—4	N.-E. 8 .	29·67	81	4 A.M. 29·67; 2 P.M. 29·64; 8 P.M. 29·72, squally.
,, ,, .	*Faise Rubanny.*	11—55	75—8	Calm .	...	...	P.M. strong S.-E. wind, heavy head sea.
,, ,, .	*Atiat Rohoman.*	Allepy		E.-N.-E. .	...	...	2 A.M. S.-E., squally; 8 A.M. E; 10 P.M. E.-S.E., moderate, rain.
,, 16th	*E. London.*	7—44	76—53	S.-W. 4 .	...	...	2 A.M. 29·70. S.-W. gale moderating; noon barometer rising.
,, ,, .	*Buckingham shire.*	8—44	73—3	N.-N.-E. 9.	29·57	81	2 A.M. 29·58; 6 A.M. 29·51; 10 A.M. 29·58; 3 P.M. wind N., hard gale; midnight wind W., rain.
,, ,, .	*Faise Rubanny.*	11—19	75—32	E.-S.-E. 10	...	...	A.M. S.-E. 8; 7 P.M. E. gale.
,, ,, .	*Ceylon Island.*	25 miles off Colombo.		S.-E. 10 .	...	...	Gale began from S.-W.
,, ,, .	*Victoria .*	12—15	75—0	E.-S.-E. .	...	...	Wind S.-E. and E.-S.-E. rising.
,, ,, .	*Atiat Rohoman.*	Allepy		E.-N.-E. .	...	...	Midnight E.-S.-E. 6, squally.
,, ,, .	*Sesostris .*	13—15	70—28	N.-N.-E. .	...	...	S.-E. swell; lightning to E. and S.
,, 17th	*Buckingham shire.*	10—20	75—5	W.-S.-W. 10	...	...	2 A.M. W.-S.-W. 9, 29·58.
,, ,, .	*Faise Rubanny.*	11—35	74—54	S.-S.-E. 11	...	...	Squally.
,, ,, .	*Mermaid .*	14—0	73—30(?)	S.-E. 9 .	29·60	...	5 P.M. 29·42; 6 P.M. S. 10.
,, ,, .	*Victoria .*	11—30(?)	75—0(?)	E.-S.-E. 9 .	29·75	...	Midnight S.-W. 10.
,, ,, .	*Atiat Rohoman.*	Allepy		E.-S.-E. to S.-E. 8 to 9	...	...	.....
,, ,, .	*Sesostris .*	13—28	72—7	N.-N.-E. and E.-N.-E. 8.	...	...	Hard squalls, violence of wind indescribable; 2 P.M. sudden calm, ship covered with aquatic birds, thousands dying on deck; 4 P.M. hurricane suddenly from W.-N.-W.
,, 18th	*Buckingham shire.*	14—10	72—59	S.-E. 12 .	28·08(?)	...	
,, ,, .	*Faise Rubanny.*	13—24	74—27	S.-E. 9 .	...	...	.....
,, ,, .	*Mermaid .*	14—5	72—30	W.-S.-W. 10	29·34	...	.....
,, ,, .	*Ceylon Island.*	9—14	74—0	S.-W. 9 .	...	...	.....
,, ,, .	*Victoria .*	12—0	74—0	S. 6 .	29·90	...	Squally.
,, ,, .	*Atiat Rohoman.*	Allepy		S.-E. to S.-S.-E. 6.	...	...	More moderate.
,, ,, .	*Sesostris .*	13—52	71—13	N. 8 .	...	...	Squally.
,, 19th	*Buckingham shire.*	15—40	73—0	Moderate W.	...	...	Rain.
,, ,, .	*Faise Rubanny.*	15—19	73—20	Moderate wind .	...	...	.....
,, ,, .	*Victoria .*	13—0	73—0	Hard S. .	...	...	Squalls.
,, ,, .	*Sesostris .*	13—28	73—14	W.-S.-W to W.-N.-W. 6.	...	...	Weather squally.

Storm No. 19. April 1847.

This storm differs in its place of origin from the other storms, which have been discussed in detail. There is no question of its having crossed the Peninsula or Ceylon, its first appearance being in about Latitude 7° N. and Longitude 75° 10′ E. The first indication of its existence is afforded by the log of the *East London*. This ship was travelling eastward in Latitude 7° 30′ N. and in Longitude 73° 30′ E., and encountered first west-north-west squalls and a briskly falling barometer, and subsequently in Longitude 74° E. ran into a west-north-west hurricane. This ship scudded round the south of the centre on

April 14th. the 14th, the wind shifting to south-west as she did so. Except when close to the centre between noon and midnight on the 14th, the wind

April 15th. was of no great force. The position of the centre on the 15th is settled by the north-east gale experienced by the *Buckinghamshire* (Latitude 9° 1′ N., Longitude 73° 4′ E.) and the west-south-west gale experienced by the *East London* (Latitude 8° 6′ N., Longitude 76° 10′ E). The po-

April 16th, and 17th. sition of the centre on the 16th and 17th is open to some doubt, as there was no ship in the immediate vicinity of the storm, and the positions are determined by vessels at some little distance. On the 18th, however, there is no question. The *Buckinghamshire*, which had run

April 18th.. north with the storm, but on its eastern side was in Latitude 14° 10′ N. and Longitude 72° 59′ E. at noon on that date, and experienced a south-east hurricane and reported a barometer reading of 28·08″. Between noon and 2 P.M. the ship's log says the violence of the wind was indescribable, but at 2 P.M. there occurred a sudden lull, during which the

Ship covered with aquatic birds while passing through centre. ship was covered with aquatic birds, thousands of which were dying on the deck. At 4 P.M. the hurricane recommenced, but the wind, which had formerly been south-east, was then west-north-west. It is hence evident that the *Buckinghamshire* passed directly through the centre, so that at noon it is placed just to the south of 14° Lat. N. in Long. 73° E.

The 18th is the latest date assigned to the storm by Piddington, but it is evident from the observations of the 19th at Bombay that a disturbance existed out at sea off Bombay, and Commander Taylor

Maskat visited by cyclone two days after Bombay cyclone. says: "In April 1847 Maskat was visited by a storm of a cyclonic character two days after the Bombay cyclone. This did great damage to the shipping in the cove; several vessels were driven on the rocks, rain fell in torrents and the streets were flooded." Hence it is possible that this powerful storm did not break up, as suggested by Piddington, after the 18th, but continued its course north-westward.

The *Swithamley*, on the 20th, in Latitude 17°31′ N. and Longitude 72°0′E, experienced a gale from north-east and east, heavy rain and lurid lightning. Weather was clear to the westward, but very black to the eastward. The Captain considered that he was on one of the spokes that led to the centre of the hurricane, and consequently kept to westward when he found he ran out of the gale.

Storm No. 19. Position of centre, and rate of motion on each day.

The following table shows the position and rate of motion of the storm :—

Date.	Position of Centre.		Direction of motion.	Distance travelled since noon of previous day.	Rate per hour.
	Latitude N.	Longitude E.			
1847.	° ′	° ′		Miles.	Miles.
April 13th	7— 0	75—10	.....	..	...
„ 14th	7—55	75— 0	N. by W.	65	2·7
„ 15th	8—55	74—55	N. by W.	65	2·7
„ 16th	9—40	74—30	N.-N.-W.	65	2·7
„ 17th	11—20	73 30	N.-N.-W.	130	5·4
„ 18th	13—50	72—50	N.-N.-W.	178	7·4
„ 19th	17—30	70—50	N.-N.-W.	275	11·5
„ 20th	20—30	66— 0	W.-N.-W.	362	15·1
„ 21st	23—10	59— 0	W.-N.-W.	522	22·0

This storm is important as typical of a large class which form in the second quarter of the year off Ceylon or Malabar and travel northward up the coast. They are frequently very severe, and, as they pass up a most frequented part of the ocean, are very dangerous. Apparently the rate of motion increases as the latitude increases. In the present instance the movement between the 13th and 16th was very slight, not averaging 3 miles per hour. Between the 16th and 17th this rate had risen to 5·4 miles, and between the 17th and 18th to 7·4 miles per hour. These rates are somewhat lower than those estimated by Piddington.

Earliness of season at which storm occurred.

The earliness in the season at which this storm occurred is worthy of note.

The only other instance prior to this was the storm No. 4 of the 20th and 21st April 1782, which pursued a nearly similar course.

April 1848. Pl. LVII.

Storm No. 20.—On April 23rd, 1848, a hurricane occurred off Ceylon, of which, however, there is no detailed information.

May 1851. Pl. LVIII.

Storm No. 21.—On the 6th of May 1851 a furious hurricane prevailed at Madras, and, sweeping across the Peninsula, sent a tremendous swell towards Sind. Another hurricane raged at the same time off Ceylon. Beyond these meagre notices there is no information obtainable.

November 1851. Pl. LXII.

Storm No. 22.—On November 21st, 1851, there occurred a gale between Bombay and Karachi. The gale was experienced throughout the Gulf of Kutch, and many boats were wrecked and foundered. It first commenced as a N.-E. fresh breeze at daybreak. The barometer was then much the same as on the day before, but afterwards fell towards 10 A.M., by which time the wind had gradually veered to S.-E. and become a moderate increasing gale. Rain likewise fell. From 11 A.M. to 3 P.M. the wind was strongest, blowing a strong S.-E. gale at times in squalls. Towards evening the wind veered to S.-W. During the gale the ship *Surat* foundered. The cyclone was probably travelling from some southward to some northward point.

Storm No. 23. March 1853.

Storm No. 23.—On the 26th to 28th March 1853 a furious hurricane prevailed all over Southern India. Fifty vessels were sunk or wrecked on the Coromandel coast. This gale is given in Mr. Chambers' list of storms in the Arabian Sea; but there appears to be no further information about it.

October 1854.

Storm No. 24.—On the 6th of October 1854 a hurricane is said to have occurred to the south of Ceylon.

November 1854. Pl. LII. Great destruction and loss of life at Bombay.

Storm No. 25.—During the 1st and 2nd of November 1854 a furious hurricane prevailed on the west coast of India. At Bombay 1 000 human beings and half a million worth of property perished in four hours. The full details of this storm are to be found in an account in the Transactions of the Bombay Geographical Society, by Dr. George Buist.

Reference—Transactions, Bombay Geographical Society, Vol. XII, p. 25.

The following figures give the data on which the course and positions of the storm centre are founded. The list of vessels exposed to the influence of the hurricane is very small, and this smallness is probably attributable to the limited extent of the storm area, as well as to the shortness of its course.

Storm No. 25.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1854.		° ′	° ′				
Oct. 30th	*Tara* . .	13—37	70—30	N.-E. light .	...	...	Midnight N.-W. gale, squally.
,, ,, .	*Cadiz* . .	7—40	77—30	Fresh N.-E. (?)	29·93	...	Squally.
,, ,, .	*Norwood*	14—32	70—57	Wind flying about.	...	...	Midnight N.-W. 9.
,, ,, .	*Forfarshire* .	15—14	72—44	S.-S.-W. to S.-E. 4—6.	...	...	Midnight S.-E. 7.
,, ,, .	Bombay .	...	...	N.-N.-E. .	29·73		
,, ,, .	270 miles S. of Bombay.	...	...	S. gale . .	...	...	Wind previously easterly, squally, rainy.
,, 31st	*Tara* . .	15-1 (?)	71–0(?)	W. 8 . .	29·20	...	Midnight severe squalls from S.-W.
,, ,, .	*Cadiz* . .	10—40	75-0(?)	(?) S.-W. 6 .	29·93		
,, ,, .	*Futta* . }	15—22	71—31	W 9. . .	29·67	1	Increasing gale; P.M. heavy cross sea.
,, ,, .	*Mombaruck* }						
,, ,, .	*Norwood* .	17—0	72—0	E.-S.-E. 9 .	Bar. falling fast.	...	8 A.M. S.-E. 8.
,, ,, .	*Forfarshire* .	Bombay	...	S.-E. 6 .	29·60	85	.....
,, ,, .	Bombay .	...	...	E. by S. .	29·74	84	Overcast.
Nov. 1st .	*Tara* . .	19—0	72—0	S.-S.-W. 8 .	29·50	...	5 P. M. S.-S.-E.; 8 P.M. E.-S.-E. 29·17; 9 P.M. N.E. 10, 29·10; midnight 29·0 N.-E. 10.
,, ,, .	*Pottinger* .	6 miles N.-E. of Colaba.		.....	29·58	...	.....
,, ,, .	*Futta* . }	16—43	70—58	N. 12 . .	29·69	...	.....
,, ,, .	*Mombaruck* }						
,, ,, .	*Arrakan* .	17—24	71—26	N.-N.-W. 10.	29·50	...	4 A.M. N.-E. 8; 8 A.M. 29·40, N.-N.-E. 10; 3 P.M. 29·55, N.-W. 8.

Storm No. 25.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1854.		° ′	° ′				
Nov. 1st.	Bombay .	...	...	E. S. E. .	29·74	...	.....
,, ,, .	*Cadiz* .	11—40	75—0	S.-W. 7 .	29·99	...	Squally.
,, ,, .	*Norwood* .	18—10	71—50	S.-E. 12 .	...	...	10 P.M., barometer rose; midnight wind N.-W. 8.
,, ,, .	*Triumph* .	16—30	73—0	S.-W. 10 .	...	...	
,, 2nd	*Cadiz* . .	15—5	73—0	Fresh S.-W. .	...	...	Squally.
,, ,, .	*Futta* }	17—27	72—15	{ N.-E to { E. light }	29·80	81	Very heavy N.-W. swell on.
,, ,, .	*Mombaruck* }						
,, ,, .	*Norwood* .	Off Bombay		Calm . .	..	...	
,, ,, .	Bombay .	...	...	N.-W. light .	29·76	80	2 A.M. 29 39, S.-E. 10; 4 A.M. 29·18, S. 12. 6 A.M. 29·46, W.-N.-W. hurricane moderating.
,, ,, .	*Pottinger* .	Six miles N.-E. of Colaba.		.....	...		4 A.M. 29·235. 5 A.M. 29·115.

Storm formed off west coast

The cyclone was apparently formed off the west coast of India in about the parallel of 13° N. On the 30th of October there was very little indication of bad weather, the only gale recorded being a fresh southerly gale on the coast 270 miles south of Bombay. At noon on this day, if the centre were formed, it lay in about Lat. 13° 20′ N. and Long. 72°35′ E. South-easterly winds were reported by the *Forfarshire* (Lat. 15° 14′N., Long. 72° 44′E.) and north-easterly winds by the *Tara* (Lat. 13° 37′N., Long. 70° 30′E.). By midnight both ships reported gales—in the case of the latter from north-west, in the case of the former from south-east; hence by midnight on the 30th there was no doubt of the existence of the cyclone. The logs at noon on the 31st showed that the storm had apparently intensified, and that the centre had travelled quickly northward, its position then being in Lat. 16° 10′N. and Long 71° 40′E. The ships *Tara* and *Futta Mombaruck* in Lat. 15°N. and Long. 71°E. both had westerly gales, while the *Norwood* in Lat. 17°N. and Long. 72°E. had a strong east-south-east gale,—observations which sufficiently closely indicated the position of the centre. The lowest barometer reported was 29·20″ on the *Tara*. On the 1st the centre lay in Lat. 17° 30′N. and Long. 71° 30′E., as shown by the observations of the *Norwood*, the *Arrakan*, and the *Futta Mombaruck*: the first vessel (Lat. 18·10°N., Long. 71° 50′E.) had the wind south-easterly 12; the second (about Lat. 17° 24′N., Long. 71°26′E) had a hurricane first from north-north-east, and then from north-north-west; the third, which by estimation was in Lat. 16° 43′N. and Long. 70° 58′E., had a northerly hurricane. The positions given by the *Tara* are open to the gravest doubt. The ship was apparently to the northward of the centre at noon on the 1st, but she was overtaken by the storm and experienced gales of great fury on the night of the 1st and morning of the 2nd, first from north-east,

October 30th.

October 31st.

November 1st.

Storm No. 25.

then from north-west. At noon on the 2nd there was no evidence of the continued existence of the storm shown by the logs of any of the ships.

Dr. Buist's account of the storm.

Dr. Buist's account of this storm is as follows:—"The storm is supposed to have sprung suddenly into existence over the sea a little to the northward of Vingorla, travelled at a rate of about 15 miles an hour on a course north by west till it passed Bombay, when its path took an eastward bend towards Tanna and Callian. As it approached the Ghâts, 70 miles to the north-west (? north-east) of Bombay, it vanished almost as abruptly as it appeared."

According to the positions plotted on the chart, the storm travelled exactly 290 miles between noon, 30th October, and noon, November 1st, which would give 6 miles per hour as its rate of progress, which is more likely than the 15 miles assigned by Dr. Buist. The lowest barometer reading at Bombay was at 4 A.M. on the 2nd, so that apparently on approaching the coast the rate was accelerated, and between noon on the 1st and 4 A.M. on the 2nd became 9 miles per hour.

Principal features of storm.

The principal features of the storm are: 1st, the northerly position in which it originated; and the suddenness of its appearance and development; and 3rd, the north-easterly movement after passing Bombay.

Position of centre and rate of motion each day.

The following table shows the position and rate of motion of the storm:—

Date.	Position of Centre.		Direction of motion.	Distance travelled since noon of previous day.	Rate per hour.
	Latitude N.	Longitude E.			
1854.	° ′	° ′		Miles.	Miles.
Oct 30th .	13—20	72—35	...	...	...
„ 31st .	16—10	71—40	N. by W.	196	8·0
Nov. 1st .	17—30	71—30	N. by W.	87	3·6
„ 2nd .	19— 5	73—30	N.-E. .	174	7·3

Storm No. 26. October 1855. Pl. LXI.

Storm No. 26.—On October 29th and 30th in 1855 a cyclone occurred in the Arabian Sea. The information regarding this storm is very scanty. The French ship *Bayadère*, in Latitude 16°30′ N. and Longitude 58° E., on the 27th experienced a severe hurricane from north-west. During the 28th there was no notice of the storm, but on the 29th the *Chevalier* from Aden to Bombay in Latitude 14°24′ N. and Longitude 55°28′ E. had, at 6 P.M., very threatening weather, a very high sea from east, and the wind east-north-east. By midnight the wind had increased to a complete hurricane, which lasted till noon of the 30th, after which hour the weather moderated and the wind veered to south-east. The vessel had to put back to Aden to refit. From this account the storm would seem to have travelled from the north-westward to the south-eastward.

Storm No. 27.—In April 1856 a cyclone occurred in the north of the Arabian Sea between the Kooria Mooria Islands and Aden. Beyond the fact that it was experienced by several vessels and that the East India Company's steamer *Queen* put back to Aden, no information is available.

Storm No. 27. April 1856. Pl. LVII.

Storm No. 28.—On the 20th November 1857 Colombo was assailed by a hurricane of unusual violence, but the available information does not show whether the gale was occasioned by a cyclone or not.

November 1857. Pl. LXII.

Storm No. 29.—On the 20th of May 1858 a squall, which lowered the barometer nearly 0·2″, occurred at Bombay and an equally severe squall was felt at Cochin and on the South Malabar coast. In Mr. Chambers' List of Cyclones it is stated that between the 15th and 20th May there was a cyclone in the Bay, which crossed to Malabar. It appears, however, from Dr. Buist's catalogue that the cyclone in the Bay passed northward into Bengal, so that it is probable that it was quite unconnected with the squalls on the west coast of India.

May 1858. Pl. LVIII.

Storm No. 30.—Between April 21st and 28th in 1859 a cyclone crossed from the Bay to the west coast of India, and there is some evidence even of its having crossed the whole breadth of the Arabian Sea and having been felt at Aden. The cyclone was first experienced at Negapatam on the 24th of April, where it proved very disastrous to the shipping. The American ship *Colorado* was wrecked at Port Pedro (north-east extremity of Ceylon) on the same date.

April 1859. Pl. LVII.

Originated over the Bay.

The storm raged at Allepy on the 25th and at Tellicherry on the 27th. Between 9 P.M. and midnight on the 27th the wind was south-south-west force 12 at Tellicherry. On Sunday, the 1st of May, a severe storm was experienced at Aden. The rain was excessive, and the wind exceedingly strong. Of course this may be a mere coincidence, but, considering the very exceptional character of such weather at Aden, it is possible there may be some connection between the two events.

Crossed the west coast.

Felt at Aden.

Storm No. 31.—On the 2nd and 3rd of June 1859 a cyclone occurred in the Arabian Sea in Latitude 15°30′ N. and Longitude 66° E.

June 1859.

The only record of this storm is found in the log of the ship *Typhoon*, which was on her voyage from Aden to Bombay. At 7 A.M. on the 3rd, in the position given above, the wind increased to the force of a gale, but with no steady direction. At 8 A.M., however, the wind settled into south-west and a furious gale blew. Just before the south-west wind struck the ship a calm fell suddenly, while heavy dark masses of cloud rolled about above in dire confusion, the sea rose in crested masses, and the ship became *inundated with numbers of beautiful butterflies, while many species of sea birds crowded the deck.* This account shows that the ship passed through the centre of a cyclone, which, as there was a southerly gale at Bombay on the preceding days, probably advanced to the position noted from the eastward.

June 1859. Pl. LIX.

Deck covered with butterflies and birds when within centre of storm.

Storm No. 32. November 1862. Pl LIII.

Reference— Transactions, Bombay Geographical Society, Vol. XVI, p. 127.

Originated off S.-W. coast of India.

Storm No. 32.—Between November 19th and 23rd in 1862 a severe cyclone passed northward along the Konkan coast. The details of the storm, so far as they are known, are given by Lieutenant Fergusson, I. N., in the Transactions of the Bombay Geographical Society. In this account no barometer readings are quoted, but the wind directions leave no doubt that the storm was a cyclone, and the logs of the various vessels involved in the storm show that it was a severe one. For the 19th the logs of four vessels were received. Two vessels in Lat. 11°N. and Long. 75°E. had south-easterly gales. One further to the south in Lat. 8° 45′N. and Long. 76°E. had a south-south-easterly gale, and one still further to the south in Lat. 4°N. and Long. 76°E. had a south-westerly gale. Hence the centre on this day is placed in Lat. 6° 40′ N. and Long. 73° 0′ E. immediately to the south of Minikoi. For the 20th there are the records of three ships, *viz.*—

November. 20th.

	Lat. N. ° ′	Long. E. ° ′	
Good Success . . .	in 12—50	74— 0	with a S.-E. gale.
St. Palhmon . . .	„ 13—54	68—13	„ E.-N.-E. gale.
Pearl	„ 12—45	74—45	„ S.-E. gale.

Hence the centre may be presumed to have travelled north-westward, and on that day to have been in Lat. 9° 45′E. and Long. 70° 2′N. For the 21st there are available the logs of five ships :—

November 21st.

	Lat. N. ° ′	Long. E. ° ′	
St. Palhmon . . .	in 15—28	68—42	with a S.-W. gale.
Delhi	„ 18—12	66—0	„ N.-E. gale.
Jamsetjee Jeejeebhoy .	„ 18—0	67—16	„ E.-N.-E. gale.
Cecrops . . .	„ 17—23	68—27	„ E. by S. gale.
Shakespeare . . .	„ 14—45	71—10	„ S.-W. gale.

With these observations the centre of the cyclone is calculated to be in Lat. 16° 30′N. and Long. 68° 20′E.

The position of the cyclone's centre at noon on the 22nd was determined from the following observations :—

November 22nd.

	Lat. N. ° ′	Long. E. ° ′	
The *Good Success* . .	in 16—38	72—55	had a S.-W. gale.
Shakespeare . . .	„ 15—36	71—36	„ W.-S.-W. gale.
Coromandel . . .	„ 18—52	72—40	„ S. gale.
Earl of Clare . . .	„ 17—40	72—55	„ S.-S.-W. gale.
Jamsetjee Jeejeebhoy .	„ 17—23	66—48	„ N.-N.-W. gale.
Delhi	„ 18—22	66—10	„ N. gale.

And the centre is placed in Lat. 18° 45′N. and Long. 69° 20′E. The storm had consequently moved slowly north-north-eastward.

After noon on the 22nd the cyclone moved east-north-eastward towards the coast, and by noon on the following day, the 23rd, lay about 90 miles inland to the east of Damaun.

Storm No. 32.

Position of centre and rate of motion each day.

The following table shows the position and rate of motion of the storm:—

Date.	Position of Centre.		Direction of motion.	Distance travelled since noon of previous day.	Rate per hour.
	Latitude. N.	Longitude. E.			
1862.	° ′	° ′		Miles.	Miles.
Nov. 19th	6—40	73— 0	...	...	...
„ 20th	9—45	70— 2	N.-W. by W.	(?) 200	12
„ 21st	16—30	68—20	N. by W.	(?) 478	20
„ 22nd	18—45	69—20	N.-N.-E.	174	7
„ 23rd	20—20	74—35	E.-N.-E.	362	15

The storm hence travelled on a curved course, passing first to north-west, then to north, and finally to north-east. Between noon on the 19th and noon on the 20th the rate per hour was 12 miles; between the 20th and 21st 20 miles per hour; between the 21st and 22nd 7 miles per hour; and between the 22nd and 23rd 15 miles per hour. The distances travelled during the first two days are, in the opinion of the writer, open to doubt, though at this distance of time it is impossible to check the positions assigned to the cyclone on those dates by Lieutenant Fergusson.

Gale severely felt among Laccadives and Maldives, and P and O. Co.'s steamer *Columbia* lost on Minikoi.

The force of the gale was fearful, but the extent of the storm-area was comparatively small, the diameter being about 450 miles. It was severely felt amongst the Laccadive and northern portion of the Maldive Islands, and the Peninsular and Oriental Company's steamer *Columbia* was lost on Minikoi Island. The rain was excessively heavy, and one remarkable feature was the unusual sultriness of the weather, with a long suspicious swell prior to the appearance of the storm. The calm oppressiveness of the atmosphere was now and then suddenly disturbed by a heavy passing squall, with torrents of rain.

January 1863. Pl. LV.

Storm No. 33.—On January the 18th, 1863, there was a gale in Lat. 22° to 23°N. and Long. 60° 30′E., which lasted four days, but there is no information as to the wind's direction, or whether the gale was a true cyclone.

April 1864. Pl. LVII.

Storm No. 34.—On the 29th of April 1864 a cyclone occurred off Ras Ullulah in Lat. 13°N. and Long. 51°E. It was encountered by the S.S. *Candia*, which was dismasted and had its boats blown away. The storm lasted from 9 A.M. to 6 P.M., and the wind veered from north-north-east to south-east, and blew with terrific force at 1 P.M. The barometer was lowest at noon, when it read 29·10″. Details are given in the Meteorological Magazine, Vol. I, page 61, but the book, through enquired for in the different meteorological offices in India, could not be obtained so that further information could not be given.

1867.

Storm No. 35.—A cyclone passed over Minikoi in 1867, but no details as to the track of the hurricane or of the date when it occurred are available. The only record of this cyclone which the writer has

Storm No. 35. been able to find is a sentence in the Imperial Gazetteer, Vol. VIII, p. 396, which says, "More than one-sixth of the adult male population of Minikoi perished in a cyclone in 1867."

Storm No. 36. June 1869. Pl. LIX. *Storm No. 36.*—Between June 4th and 6th, 1869, the wind rose to a gale at Bombay from south-east. The wind veered from south-east to west-south-west, so that it appears possible that a cyclone passed up the coast, though it is more probable that the gale was merely caused by the first burst of the monsoon.

Storm No. 37. January 1871. Pl. LV. *Storm No. 37.*—On January the 15th, 1871, a cyclone occurred off Ratnagiri when the S.S. *General Outram* foundered. The centre passed inland between Bombay and Ratnagiri in a north-easterly direction.

Storm No. 38. May 1871 Pl. LVIII. *Storm No. 38.*—In May 1871 between the 5th and the 7th the Austrian Lloyd's steamer *Apis* encountered a cyclone in the Arabian Sea.

On May 4th in Lat. 18° 4′ N. and Long. 66° 20′ E. the wind was moderate from between south and south-south-west. Clouds were moving fast from south to north, and the sea rough. On the 5th in Lat. 17° 48′ N., Long. 62° 29′ E. the wind gradually rose to a gale, first from west-south-west and then from west, the sea being very rough.

On the 6th in Lat. 16° 26′ N. and Long. 58° 33′ E. the storm was at its height, and so continued till 5 A.M. on the 7th. The cyclone travelled from south-east to north-west, and struck the south Arabian coast.

Storm No. 39. June 1871. Pl. LIX. *Storm No. 39.*—On the 29th and 30th June 1871 strong south by west gales were felt in the Arabian Sea between Lat. 6° and 10° N. and Long. 50° and 53° E. They were encountered by the ship *Leonidas*, but there is no direct evidence that they were part of a cyclonic storm. It will be seen from the Arabian Sea charts that gales of this character are the rule, not the exception, in this part of the Arabian Sea at this season.

Storm No. 40. October 1871. Pl. LXI. *Storm No. 40.*—In October 1871 (the exact date is not given) a cyclone occurred in the Arabian Sea between Socotra and Bombay, in which the *Serapis* suffered considerably.

Storm No. 41. March 1874. Pl. LVI. *Storm No. 41.*—In March 1874 (the exact date is not known) a west-north-west to north-west gale was felt in the north of the Arabian Sea. It lasted for two days and progressed from the entrance to the Persian Gulf towards the Kutch coast.

Storm No. 42. May 1879. Pl. XLIX. *Storm No. 42.*—In May 1879 a cyclonic storm crossed the Madras coast early on the morning of the 21st, and in Mr. Chambers' list this storm is taken to be the same as that which passed up the Bombay coast between the 21st and 26th. It appears, however, more probable that the Madras storm broke up over the Deccan between the 21st and 22nd, as there is no distinct indication that the centre of the storm actually crossed the Peninsula. The only sign of disturbance on the west coast on the 21st was the north-westerly strong

Storm No. 42.

wind and gale which the *Shahjehan* experienced, but this can hardly have been the effect of a cyclone, which at that time had hardly crossed the coast on the opposite side of the Peninsula. It may therefore be fairly supposed that the storm commenced over the Arabian Sea. The information for the earlier days of the storm is very scanty, and the positions assigned to the centre on the 21st and 22nd are, as mentioned above, very doubtful. The storm is supposed to have travelled almost due north, and the centre has been placed in Lat. 11° 50′N. and Long. 73° 30′E. on the 21st, and in Lat. 14° 20′N. and Long. 72° 50′E. on the 22nd. For the 23rd the available information is as scanty as for the earlier days, but the position of the centre is more satisfactorily settled, the storm having passed over a vessel (name unknown) at 3 P.M. on the 23rd. At noon on the 23rd this vessel lay in Lat. 17° 32′N. and Long. 72° 0′E, and experienced a strong westerly gale. She presumably ran round the storm and finally into the centre at 3 P.M. She experienced a dead calm for one hour with torrential rain, and then the hurricane recommenced from north-north-west backing to west. The centre at noon on this day is hence placed in Lat. 17° 45′N. and Long. 72° 0′E. On the following day the centre again passed over a vessel, and hence the position of the storm on this day also is known with fair accuracy. The *James Livesay*, which was in Lat. 19°N. and Long. 72°E. at noon, had a south-westerly hurricane, so that the centre was probably close to, but a little to the northward of, this position. The barometer fell briskly and steadily till 1 P. M. when the ship ran into the calm centre, after which the barometer rose. The centre of the storm at noon was hence approximately in Lat. 19° 5′N. and Long. 71° 30′E.

May 21st.

May 22nd.

May 23rd.

Vessel passed through centre, experiencing dead calm and torrential rain. May 24th.

The following are the data giving the information on which the positions of the centre have been determined:—

Date.	Name of Ship.	Latitude. N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1879.		° ′	° ′				
May 19 .	*Shahjehan* .	7—8	78—5	W.-S.-W. 8	...	...	Wind drew towards N.
„ 20 .	*Do.* .	9—12	76—6	W.-S.-W. 8	...	...	Blowing gale, heavy cross head sea.
„ 21 .	*Do.* .	11—13	75—11	N.-W. 8	...	...	Wind drew to N.-N.-W. and N.-E. and back to N.-W.
„ 22 .	*Do.* .	12—52	74—28	S.-W. 7	...	...	4 P. M. wind veering westward, force 9.
„ 23 .	*Do.* .	14—6	73—59	S.-W. 7	...	...	.....
„ 24 .	*Do.* .	15—53	73—14	S.-W. 7	...	...	Blowing strong wind and sea going down.
„ 21 .	*James Livesay*	14—13	68—14	N.-W. 6	29·92	87	.....
„ 22 .	*Do.* .	16 -31	70—11	N.-W. to N.-N.-W. 7 .	29·84	86	Wind rising, sea high.
„ 23 .	*Do.* .	18—29	72—18	N.-N.-W. 7	29·73	...	4 A.M. 29·75, heavy rain squall. Noon 29·73. 4 P.M. 29·50; midnight fresh gale.

Storm No. 42.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1879.		° ′	° ′				
		(?)	(?)				
May 24 .	*James Livesay*	19—0	72—0	S.-W. 12	29·18	...	1-30′ A.M. heavy gale, barometer falling. 4-0 A.M. barometer 29·20, W.-S.-W. 12. 1 P.M. barometer rising. Wind lulling for a time, then blowing up harder than ever. 5 P.M. gale blown out.
,, 18 .	Name (unknown) .	8—50	(?)	W.-N.-W. to N.-W.	...	..	8 P.M. 29·7. 3 P.M. calm for one hour, torrential rain.
,, 22 .	Do. . .	(?)	(?)	8 P.M. N.-W.	...	...	Squally.
,, 23 .	Do. . .	17—32	72—0	W. 10	29·20	...	4-30 P.M. hurricane recommenced, gale began N.-N.-W. round to W.
,, 24 .	Do. . .	16—44	71—0	W.	...	...	.....

It is obvious from the remarks above that any estimate of the rate of the storm for the days earlier than the 23rd is impossible. During the last 24 hours of its existence the rate of motion was only 4 miles per hour; the storm was subsequently felt on the Cutch coasts, but there is no definite information before noon of the 23rd or after the 24th.

Position of centre, and rate of motion on each day.

The following table shows the position and rate of motion of the storm :—

Date.	Position of Centre.		Direction of motion.	Distance travelled since noon of previous day.	Rate per hour.
	Latitude N.	Longitude E.			
1879.	° ′	° ′		Miles.	Miles.
May 21st	11—50	73—30	...	...	...
,, 22nd	14—20	72—50	N by W.	174	7·0
,, 23rd	17—45	72—0	N. by W.	232	10·0
,, 24th	19—5	71—30	N. by W.	102	4·0

Storm No. 43. November 1880. Pl. LXII.

Storm No. 43.—In November 1880 there is an instance of a cyclone crossing the east coast of the Peninsula and of the occurrence of simultaneous or immediately subsequent bad weather in the Arabian Sea without however the observations showing any distinct connection between the two phenomena. The observations of the 21st November indicated a deep but small depression approaching Negapatam from the eastward. The observations of the 23rd apparently showed that this depression had been broken up by the Shevaroy and Palni hills; yet a cyclone was encountered by the S. S. *Albula* in Lat. 17°N. and Long. 66°E. in the Arabian Sea. The date on which the *Albula*

Originated over the Bay.

encountered the cyclone has not been noted, but if it were the 22nd or 23rd, the storm could hardly have been the same as that which crossed the Madras coast at Negapatam about noon of the 22nd.

Storm No. 43.

Storm No. 44.—At the close of May and early in June 1881 a violent cyclone was felt in the Arabian Sea moving from east to west. Full details of this cyclone are given by Mr. F. Chambers in the Indian Meteorological Memoirs.

Storm No. 44. May-June 1881. PL. XLIX. *Reference*—Indian Metl. Memoirs, Vol. IV, p. 261.

The following data, extracted from Mr. Chambers' Memoir, have been used to determine the position of the centre on each day:—

Date.	Name of Ship.	Position. Latitude. N.	Position. Longitude. E.	Barometer.	Wind.	Weather Remarks.
1881.		° ′	° ′			
May 25th	*Deva Gangadur.*	14—4	64—15	29·794	N.-N.-W. 3	Thunder, lightning squalls, wind very unsettled force and direction.
,, ,, .	*Cympromene*	13—33	68—10	29·779	S.-S.-W. 3	Light breeze, fine.
,, 26th	*Deva Gangadur.*	13—58	65—48	29·695	N.-W. 7 to 8	Gale increasing, heavy squalls.
,, ,, .	*Cympromene*	14—35	69—30	29·819	S.-S.-W.	Fine weather.
,, ,, .	*Berengaria* .	16—23	66—11	29·750	N.-E. 2	Fine, very heavy sea from S.-E.
,, 27th	*Africa* . .	16—2	66—55	29·809 (?)	N.-E. 5 to 6	Barometer falling, cloudy.
,, ,, .	*Berengaria* .	15—22	67—19	29·650	E.-N.-E. 7 to 8	Heavy squalls and rain.
,, ,, .	*Deva Gangadur.*	13—45	66—15	29·496	N.-W.	Very heavy squalls.
,, ,, .	*Cympromene*	15—57	70—41	?	S.	Pleasant breeze, fine.
,, 28th	*Africa* . .	15—10	66—50	29·679 (?)	N.-N.-W. 8 to 10.	Wind and squalls increasing, ship unmanageable 10 P. M. 28·799, wind; S.-W.
,, ,, .	*Berengaria* .	14—49	67—29	29·302	W. 9 to 10	Heavy rain; very squally.
,, ,, .	*Clan Alpine.*	17—42	65—50	29·472	N.-E. 8	.....
,, ,, .	*Cympromene*	17—51	72—10	?	S.	Fine.
,, ,, .	*Deva Gangadur.*	13—35	66—40	29·595	W. 7 to 8	Squally; heavy sea from N.
,, ,, .	*Inchulva* .	16—36	63—47	29·694′	N.-W. 4	Cloudy; heavy swell from S.-W., distant thunder.
,, ,, .	*Mercedes* .	17—41	67—39	29·784	E. 7	Gale from E.; heavy sea from S.-E.
,, ,, .	*Mistley Hall*	13—59	64—6	29·640	W. 8	Torrents of rain, terrific squalls.
,, ,, .	*Sestos* . .	18—33	67—51	29·714	E. 4	
,, 29th	*Berengaria* .	16—36	69—47	29·650	S.-E. 4	
,, ,,	*Clan Alpine.*	18—18	67—48	29·492	S.-E. 9	Heavy gale, high southerly sea.
,, ,, .	*Deva Gangadur.*	13—28	67—2	29·595	S.-W. 7	Squalls, heavy showers.
,, ,, .	*Inchulva* .	16—30 (?)	65—50 (?)	27·15	N.-E. 12	At 2 P.M. calm and in centre of cyclone fearful boiling sea; 2 40 P.M. light wind from S.-W., increasing in few minutes to greater violence than N.-E. wind. Bar. rose to 28 inches in less than one hour. Torrents of rain.

Storm No. 44.

Date.	Name of Ship.	Position. Latitude N.	Position. Longitude E.	Barometer.	Wind.	Weather Remarks.
1881.		° ′	° ′			
May 29th	*Mercedes* .	17—40	64—11	29·474	N.-N.-E. 9	Afternoon northerly hurricane; fearful sea.
,, ,, .	*Mistley Hall*	15—15	66—22	29·310	W.-S.-W. 12	.....
,, ,, .	*Rohilla* .	16—46	63—53	29·515	W.-N.-W. 9	Ship kept to S.-E., gale moderating.
,, ,, .	*Sestos* . .	18—5	64—16	29·547	E.-N.-E. 7	Wind and sea increasing. Barometer falling.
,, 30th.	*Africa* . .	15—44	67—40	...	...	.....
,, ,, .	*Bessie Morris*	15—50	65—16	29·715	W.-S.-W. 7	Gale moderating.
,, ,, .	*Clandon* .	15—19	58—50	...	W.	Wind increasing; midnight, strong gale.
,, ,, .	*Deva Gangadur.*	15—14	67—2	29·595	S.-W.	Squally, showery.
,, ,, .	*Eschoe* .	15—28	58—4	29·502	S.-W.	4 P.M., 29·202. Wind freshening, and very heavy swell.
,, ,, .	*Inchulva* .	?	?	...	S.-E. to S.-W.	Strong breeze.
,, ,, .	*John Pender*	18—3	61—46	29·420	W.-N.-W. 9	A.M. strong gale, violent squalls; P.M. terrific gale, midnight 29·200.
,, ,, .	*Mercedes* .	15—50	64—3	29·422	S.-W. 11	A.M. N.-W. hurricane; P.M. S.-W. strong gale, barometer rising.
,, ,, .	*Mistley Hall*	14—59	66—0	?	S.-W.	Gale moderating.
,, ,, .	*Sestos* . .	17—14	62—50	29·453	S.-W. 11	A.M. terrific gale from N. through W. to S.-W.; P.M. gale breaking.
,, ,, .	*Wheatfield* .	16—59	61—48	?	W.-S.-W. 10	Whole gale and very high sea.
,, 31st	*Clandon* .	16—11	63—3	?	S.-W. 6	.....
,, ,, .	*Eschoe* .	16—15	61—50	...	S.-W. 9	Strong gale and very heavy sea.
,, ,, .	*John Pender*	?	?	?	S.-W. 9	A.M. terrific westerly gale, tremendous sea; 4 A.M. bar. 29·20, 6 30 A.M. 29·06; P.M. wind S.-W. and bar. rising, but squalls terrific.
,, ,, .	*Mercedes* .	15—42	63—57	29·582	S.-S.-W. 9	Violent gale and terrific sea.
,, ,, .	*Sestos* . .	17—10	63—15	29·614	S.-W. 7	.....
,, ,, .	*Tebe* . .	16—19	60—54	29·465	S.-W. 7	.....
,, ,, .	*Wheatfield* .	18—3	65—30	29·583	S.-W. 5	.....
June 1st .	*Arabia* . .	Muskat to Guadur.		29·766	E. 4	.....
,, ,, .	*Brinkburn* .	16—0	60—21	?	S. 9	.....
,, ,, .	*Eschoe* .	17—10	65—25	?	S.-W. 7	.....
,, ,, .	*John Pender*	?	?	29·500	W.-S.-W. 9	A.M. hard gale, tremendous sea and squalls; P.M. gale more moderate.
,, ,, .	*Mercedes* .	15—50	62—33	29·422	S.-S.-W. 8	Violent gale and heavy sea.
,, ,, .	*Mistley Hall*	16—52	60—8	?	S.-W. 12	A.M., S.-W. hurricane; P.M. wind decreasing.
,, 2nd	*Arabia* .	Muskat to Karachi.		29·820	S.-E. 2	Tremendous swell from south.
,, ,, .	*John Pender*	18—15	60—34	29·530	S.-S.-W. 8	Weather moderating; sea very high.
,, ,, .	*Mercedes* .	16—37	65—14	29·702	S.-S.-W. 7	Still very high sea.

Storm No. 44. May 25th.

The daily history of this storm is abridged from Mr. Chambers' account of it in the Indian Meteorological Memoirs. On the 25th there were already indications of the formation of a depression. The isobar of 29·8″, which in the western half of the Arabian Sea ran from west to east along the parallel of 14°E., bent to the southward between Long. 62° and 67°N., and then ran northward again to its former level. There was thus in Long. 66° to 67°E. and Lat. 10° to 14°N. an area of abnormally low pressure, while an indication of cyclonic action was given by the ship *Deva Gangadhur* in Lat. 14° 4′N. and Long. 64° 15′E., reporting a north-north-west wind, and the *Cympromene* in Lat. 13° 33′N. and Long. 68° 10′E. a south-south-west wind. On the 26th a similar distribution of pressure prevailed, but within the low pressure area noticed above the barometer had fallen about 0·1″, and a distinct centre had been developed in about Lat. 13° 48′N. and Long. 66° 56′E. The *Deva Gangadhur* (Lat. 13° 58′N., Long. 65° 48′E.) had now a north-west moderate gale, with heavy rain squalls; the *Berengaria* (Lat. 16° 23′N., Long. 66° 11′E.) a light north-east breeze with heavy sea from south-east and the *Cympromene* (Lat. 14° 35′N., Long. 69° 30′E.) a moderate south-south-west wind and heavy swell from south-west. On the following day, the 27th, pressure over the storm area had fallen from one to two-tenths of an inch, and readings of below 29·5 inches were reported rear the centre. There had been very little change in the position of the storm, though the affected area had increased. The centre was in Lat. 13° 48′N. and Long. 66° 56′E., which was practically the same as on the previous day. The wind had risen, and was blowing a strong gale; with violent squalls of wind and rain. Between noon on the 27th and noon on the 28th pressure over the storm-area fell about two-tenths of an inch, while the centre of the storm had moved northwards to about Lat. 15° 9′N. and Long. 67° 28′E. The lowest pressure recorded at noon on this day was 29·3″, but at 7-30 A.M., when the *Berengaria* was closer to the centre than any ship was at noon, a pressure of 29·15″ was recorded, while the *Africa*, at 10 P.M., when close to the centre, reported a pressure of 28·8″. The winds around the centre were blowing with great violence. The observations of the 29th showed that the storm had still further intensified. The cyclone had moved north-westward, and the centre lay in about Lat. 16° 40′N. and Long. 66° 14′E., and the storm area had increased in extent. At 2 P.M. on this day the *Inchulva* was within the calm centre of the cyclone, and it is estimated that the pressure there was as low as 27·15″. The winds around the centre were of terrific force. After noon on the 29th the storm moved more quickly, and the centre of the cyclone at noon on the 30th lay in Lat. 18° 36′N. and Long. 63° 45′E. No ships approached very close to the centre on this day, but as the extent of the storm area had increased, it may be concluded that the barometric depression was at least equal to that of the preceding day.

Originated off west coast between Lat. 10° and 14°N.

May 26th.

May 27th.

May 28th.

May 29th.

May 30th.

Storm No. 44.

May 31st. The gales in the storm area were most intense. The reports of the 31st showed that the storm centre had continued to move forward to the west-north-westward and had reached Lat. 19° 20′ N. and Long. 61° 32′ E. The storm area had continued to expand, but no ship was near the centre on this day. It is probable that the intensity of the cyclone was equal to that of the two preceding days, as fierce gales with terrific squalls were reported within the storm area.

June 1st. The rate of motion of the storm decreased somewhat after noon on the 31st, and at noon on the 1st the centre lay in Lat. 19° 50′ N. and Long. 60° 15′ E. The storm area had contracted, and the cyclone had commenced to fill up. There were no ships in the immediate neighbourhood of the centre, and the lowest isobaric line at noon on the 1st was 29·5″.

June 2nd. Violent gales were still felt within the storm area. The chart of the 2nd of June showed that the centre of the cyclone was still further to the west-north-westward, in about Lat. 20° 33′ N. and Long. 58° 52′ E., close to the Arabian coast. The lowest pressure recorded on this day was about the same as that on the preceding day, and apparently the storm was of about the same intensity and size as on the 1st. Gales were still reported over the storm area in the rear of the depression.

Broke up against Arabian coast. The storm apparently broke up directly it touched the high lands lying along the Arabian coast, as there is no indication of a cyclone in the meteorological records received from Bushire for that period.

Position of centre, and rate of motion each day. The cyclone was in course of formation and practically without motion from noon of the 25th to noon of the 27th. After the latter hour the movement commenced. The following table shows the position and rate of motion of the storm centre :—

Date.	Position of Centre.		Direction of motion.	Distance travelled since noon on previous day.	Rate per hour.
	Latitude N.	Longitude E.			
1881.	° ′	° ′		Miles.	Miles.
May 26th	13—48	66—56	.....	...	...
„ 27th	13—48	66—56	.....	...	...
„ 28th	15—9	67—28	N.-N.-E.	102	4·2
„ 29th	16—40	66—14	N.-W. by N.	132	5·5
„ 30th	18—36	63—45	N.-W. by W.	208	8·7
„ 31st	19—20	61—32	W.-N.-W.	152	6·3
June 1st	19—50	60—15	W.-N.-W.	90	3·7
„ 2nd	20—33	58—52	N.-W. by W.	100	4·2

Diameter of storm area. The diameter of the storm area, *i.e.* the area enclosed within the isobar of 29·5″ was—

On May 27th, 90 miles.
„ 28th, 150 do.
„ 29th, 300 do.
„ 30th, 370 do.
„ 31st, 440 do.
On June 1st, 330 do.
„ 2nd, 330 do.

Storm No. 45.—This storm originated in the north-west angle of the Bay between the 25th and 27th of June 1883. It crossed the Orissa coast during the night of the 29th, and thence travelled westward through the Central Provinces and Central India, and reached Rajkote (in Kattiawar) at 10 A.M. on the 3rd July. On the afternoon of the 3rd it passed out into the Arabian Sea and was met by the B. I. S. N. Co.'s steamer the *Oriental* on the evening of the 4th July in Lat. 24° 14′N. and Long. 63° 30′E., or at a distance of about 400 miles from the Cutch coast. It appears that the storm intensified after leaving the land and passing over a water surface, and that its rate of motion decreased. The storm is remarkable as an example of a depression moving from east to west in this high latitude. As a rule, storms which reach latitudes exceeding 20°N. at this season do so from some southerly point, and seldom on an east and west track.

Storm No. 45
June-July 1883.
Pl. LI.

The following table shows the position and rate of motion of the storm :—

Position of centre, and rate of motion each day.

Date.	Position of Centre.		Direction of motion.	Distance travelled since previous date.	Rate per hour.
	Latitude N.	Longitude E.			
1883.	° ′	° ′		Miles.	Miles.
July 3rd—					
10 A.M.	23—30	69—45	W.	308	17·0
4 P.M.	23—45	68—45	W.	66	11·0
July 4th—					
8 P.M.	24—14	63—30	W. by N.	300	12·0

Storm No. 46.—A cyclonic depression appeared off Negapatam on the 16th October 1884, crossed the coast during that day, reached Madura on the 17th and passed out near Calicut into the Arabian Sea on the 18th. There is nothing known of the strength of this storm at sea, as no ship's log gives any information concerning it.

Storm No. 46.
October 1884.
Pl. LXI.

Storm No. 47.—This storm, which is known as the Aden cyclone, was one of the most intense and disastrous storms of recent years. It commenced on the 30th of May 1885 in the centre of the Arabian Sea in about Long. 60°E. and Lat. 13°N., and travelled west by south to the Gulf of Aden, and finally into Abyssinia, passing over Obock. The track and other information about this storm is derived from the logs of vessels collected by the Indian Meteorological Office, and from the German and French accounts of the cyclone. The track of the storm was almost due west until it reached the entrance to the Gulf of Aden, when, probably under the influence of the high lands of Southern Arabia, the track changed and became west-south-west.

Storm No. 47.
June 1885.
Aden cyclone
Pl. XLIX.

On the 28th May there was, so far as the observations received enable us to judge, no sign of unsettled weather in the Arabian Sea.

May 28th.

Storm No. 47.

A light easterly wind was reported by the *Royal George* in Lat. 13° 13′ N. and Long. 72° 54′E., which ship also reported a heavy swell with dark bank of clouds to south-west. The easterly wind was doubtless somewhat abnormal, but the other conditions were such as are

May 29th.

experienced each year at the setting in of the monsoon. By the 29th indications were but little advanced, the only significant facts in the observations being the west-north-west gale experienced by the *Glenochiel* in Lat. 7° 45′N. and Long. 58° 47′ E., and the heavy swell from

Shallow low pressure area overlying central parts of Arabian Sea, May 30th. May 31st.

south reported by the *Sutlej* in Lat. 15° 55′N. and Long. 58° 10′E. A large shallow, low-pressure area overlay the whole of the central parts of the Arabian Sea, extending from Long. 53° to 63° E. and from Lat. 10° to 16° N., and this continued during the 30th, and was the only sign of anything unusual in the region. On the 31st conditions had changed somewhat, the large shallow depression had contracted and become better defined, and the winds showed a slight indraught towards a centre of depression in Lat. 12° 50′N. and Long. 59° 25′E.

June 1st. Cyclone suddenly developed.

The chart of the 1st June showed a remarkably sudden development of the depression. A well-defined storm had appeared with its centre to the north of Socotra in Lat. 12° 50′N. and Long. 53° 58′E. The depression had hence travelled quickly on a due west course. There were no ships on this day in the immediate neighbourhood of the centre, and the lowest barometer reported was 29·60″. The following observations are those made nearest to the storm centre, and from which its position has been determined. The *City of Venice*, in Lat. 13° 40′N., Long 51° 30′ E., experienced a fresh north wind, and reported rain-squalls and heavy clouds to east. It is remarkable that this ship, directly in the line of advance of the storm, and, so far as can be

No indication of storm 87 miles west of centre.

estimated, only 87 miles from the storm centre, had only fresh winds and no indication of the storm. The *Diomed*, in Lat. 12° 39′N. and Long. 50° 30′E. and about 200 miles west by south of the centre, had at noon on this day variable winds and fine weather. At 8 P.M. heavy squalls began from east-north-east, which increased to a strong gale by 10 P.M., and to a hurricane at 11 30 P.M., when the barometer marked 29·05″. The *Peshawar*, in Lat. 13° 53′N. and Long. 54° 50′E., was to the north-east of the storm area and had fresh south-east winds, but by steaming hard she got into easterly gales by 8 P.M., and subsequently into the front of the cyclone. The ship *Northern* (Lat. 14° 26′N. Long. 52° 5′E.) had a fresh north-east wind and a rising south-east swell in the morning, and in the evening a hard north-east gale and very heavy swell. The *Clan Graham* (Lat. 14° 27′ N., Long. 52° 13′ E.) close to the *Northern* experienced similar weather.

June 2nd.

On the 2nd June the centre of the storm was in Lat. 12° 45′ N., and Long 50° 12 E. The cyclone had thus travelled about 240 miles in an almost due westerly direction. The lowest reading of the baro-

Storm No. 47.

meter actually observed at noon was 29·50″, but within the storm-area readings were unquestionably very much lower. The following ships were in the neighbourhood of the storm, and the position of the centre has been determined by their observations :—

1. The *City of Venice*,—Lat. 12° 41′ N., Long. 47° 15′ E., was directly in front of the cyclone at a distance of 196 miles from the centre. She was, however, travelling with the storm and at a greater rate ; hence the only evidences of the storm were strong north-east to north-west winds and clouds travelling from east.

2. The *Diomed* gives no position on this day ; at about midnight on the 1st her barometer marked 29·05″, and she experienced a hurricane from that time till 8 P.M. on the 2nd.

3. The *Peshawar* at noon on the 2nd was immediately in front of the storm centre in Lat 13° 10′ N. and Long. 49° 35′ E. The steamer apparently passed round the western limb of the cyclone, experiencing first an east-north-east gale, then a north-north-east gale, and at midnight a westerly hurricane in Lat. 12° 45′ N. and Long. 47° 45′ E.

4. The I. M. S. *Lockwood* was in Lat. 13° 50′ N. and Long. 49° 45′ E. She was travelling north-eastward towards the cyclone, but edging towards its northern side. Early in the morning the weather was dull and oppressive, and rain commenced at 2 A.M. From that hour till 11 A.M. fearful gusts and squalls from north-west were experienced. After 11 A.M. the wind veered quickly to north-north-east, and finally to east ; the westerly movement of the storm and the easterly movement of the vessel combining to carry out the change quickly. At noon the barometer marked 29° 46″, which was the lowest reading recorded on this day ; at the same time an easterly hurricane was felt, but after that hour the wind moderated and the barometer rose.

Preliminary gusts and squalls.

5. The *Cuba*, in Lat. 13° 27′ N. and Long. 49° 3′ E., experienced a hard north-east gale at noon, and the barometer marked 29·63″. Only 12 hours previously light breezes had prevailed, which at 4 A.M. quickly increased to a fresh gale.

Twelve hours before cyclonic hurricane only light breezes experienced.

6. The *Tantallon*, in Lat. 13° 16′ N. and Long. 43° 2′ E., had a light north-west wind till 10 P.M., when it freshened to a gale with thunder and lightning.

7. The *Inchulva*, in the Red Sea above Perim, had a light north-west breeze and fine weather. Towards evening the weather became squally.

Weather in Red Sea.

8. The *Duke of Devonshire* was also in the Red Sea in Lat. 14° 44′ N. and Long. 42° 19′ E., and experienced light to moderate north-westerly winds and fine weather.

9. The *Columbian* was close to the *Duke of Devonshire*, and had similar weather.

10. The *Glenochiel*, in Lat. 11° 41′ N. and Long. 51° 41′ E., off Cape Guardafui had a fresh southerly wind.

Weather on African coast.

Storm No. 47.

11. The *Clan Graham*, in Lat. 14° 56′ N. and Long. 54° 41′ E., experienced a moderate south-east gale.

12. The *Northern* lay to the east of the cyclone, in Lat. 15° 41′ and Long. 55° 5′ E., and experienced a moderate southerly gale.

At Aden, which station was in the direct path of the cyclone, a north-north-west gale was experienced all day, but the barometer was apparently not much affected.

At Massowa there was a strong gale from south-east to south-west on the 2nd, but this had no connection with the main disturbance.

June 3rd.

On June 3rd the centre of the cyclone lay in Lat. 12° 30′ N. and Long. 45° 30′ E. It had thus travelled westward during the previous 24 hours at an average rate of about 13 miles per hour. Owing to the confined position in which it now found itself, and to the number of ships which were traversing the Gulf of Aden, the information about the cyclone is more complete than hitherto.

Weather in Gulf of Aden.

Lowest barometer 27·86″.

The *Tantallon*, in Lat. 12° 20′ N. and Long. 45° 50′ E., recorded the lowest pressure yet noticed, *viz.* 27·86″. The *Inchulva* was also near to the centre, and recorded a pressure of 28·92″, with a north-east hurricane. By 2 P.M. her barometer had fallen to 28·52″. The *Clare* and the *Congo* were both in front of the storm. The former apparently passed round the northern side of the centre, experiencing a terrific hurricane, first from north-east, then from east, and subsequently from south-east and south. The *Duke of Devonshire* was off Aden at noon, and her barometer, which had fallen at the rate of 0·1″ per hour since 10 A.M., marked 29·43″ at noon. Between noon and 1 P.M. her barometer fell three-tenths, and the wind increased to a hurricane from north. The lowest reading of the barometer on this ship was 28·93″, but the time of occurrence is not given. The ship passed round the south side of the cyclone, the wind shifting to west and then to south. The log of the *Columbian* is interesting, as showing the western limits of the storm area. At noon the ship had a southerly wind, a dull squally sky, and a heavy swell from south-east. She was at this time only 95 miles to the west of the storm centre, and experienced not only no storm, but a southerly instead of a northerly wind. Two hours and a half later (at 2-30 P.M.), a north-east hurricane struck her suddenly, and she became involved in the storm. The cyclone passed to the southward of her, and she had an easterly hurricane, the barometer marking 29·11″. The next ship to the westward was the *City of Venice*, and her only indication of being in the neighbourhood of a storm was heavy clouds to the southward. The *Sahara* was further up the Red Sea, and had, in the afternoon, very thick weather, and the *Sutlej*, still further up the Red Sea, had a light north-west gale. On the eastern side of the cyclone the only ship whose log is of importance is the *Peshawar*.

Barometer fell 0·3″ in 1 hour.

Western limits of cyclone, Gulf of Aden.

Two hours before cyclonic hurricane light southerly wind.

Storm No. 47

This ship apparently passed close round the centre, her log showing that—

At midnight on the 2nd the wind was W. 10.
„ 1 A.M. on the 3rd the wind was W., the barometer 29·40
„ 2 A.M. „ „ „ W. 12 „ 29·37
„ 2-45 A.M. „ „ S. 12 „ 28·87
„ 4 A.M. „ „ S. 11 „ 29·10

The logs of other ships to the eastward exhibited no important features.

Weather on African coast.

On the night of the 3rd the cyclone crossed the African coast, and the centre lay in Lat. 12 °6′ N. and Long. 42° 42′ E. at midnight. The nearest ship was the *Sahara* in Lat. 12° 33′ N. and Long. 43° 33′ E., which experienced a strong southerly gale and rain all the morning.

Position of centre, and rate of motion each day.

The following table shows the position and rate of motion of the storm centre :—

Date.	Position of Centre,		Direction of motion.	Distance travelled since noon of previous day.	Rate per hour.
	Latitude N.	Longitude E.			
1885.	° ′	° ′		Miles.	Miles.
May 30th	12—50	60—35	...	...	...
„ 31st	12—50	59—25	West .	80	3·3
June 1st	12—50	53—58	West .	362	15·0
„ 2nd	12—45	50—12	West .	247	10·0
„ 3rd Noon	12—30	45—30	West .	312	13·0
Midnight	12—6	42—42	West by South.	189	16·0

References—

Full details of this important cyclone will be found in the *Annalen der Hydrographie* of Berlin, 1886 and in Admiral Cloué's accounts given in the Annales Hydrographiques, Premier Semestre, 1886, and in the *Revue Maritime et Coloniale* of March 1887.

Admiral Cloué writes—

"Le cyclone du golfe d'Aden a été tout à fait exceptionnel—

"1° Par sa course extraordinaire de l'est à l'ouest, qui l'a fait pénétrer jusqu'à l'entrée de la Mer Rouge, et même bien au delà, parcourant d'un bout à l'autre le golfe d'Aden, qui, de mémoire d'homme, n'avait pas été visité par un aussi terrible météore.

"2° Par la diminution graduelle de son diamètre à mesure qu'il s'avançait vers l'ouest, ce qui est contraire aux observations faites jusqu'ici. On a toujours affirmé que les cyclones se dilataient à mesure qu'ils s'avançaient et qu'ils arrivaient ainsi à se dissoudre après une course plus ou moins longue. Or, le cyclone du golfe d'Aden, qui avait 150 milles de diamètre en dehors de Socotra, était réduit à 50 milles en arrivant à Obock. Ainsi, au lieu de se dilater, il se contractait à mesure qu'il pénétrait au fond du golfe, sans doute parce qu'il ne recueillait aucun aliment sur sa route? La masse de nuages orageux se consommant sans se renouveler, l'ouragan a peut-être pris fin comme une simple trombe.

Annales Hydrographiques premier semestre, 1886; Revue Maritime et Coloniale, Mars, 1887; Annalen der Hydrographie, Berlin, 1886.

Storm No. 47.

Nous avons pris le cyclone à 250 milles à l'est de Socotra, et nous l'avons accompagné jusqu'au fond du golfe d'Aden, même un peu au delà. Il a au début 150 milles de diamètre et se transporte vers l'ouest avec 8 nœuds de vitesse seulement. A Socotra le diamètre est de 140 milles, le centre passe à 6 milles au nord de l'île, avec une vitesse de 8·5 nœuds. Plus loin, le cyclone coupe le méridien de cap Guardafui avec un diamètre de 130 milles et plus de 9 nœuds de vitesse. Cette vitesse continue d'augmenter graduellement pendant que le diamètre diminue; elle est de 14 nœuds lorsque le cyclone atteint Aden avec seulement 60 milles de diamètre. A l'ouest de Aden la vitesse est de 14·5 nœuds, et elle atteint 15 nœuds à Obock; mais le diamètre du cyclone n'est plus que de 50 milles."

Storms Nos. 47 and 48.

The following are the data giving the information on which the positions of the centre have been determined for storms Nos. 47 & 48:

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
		° ′	° ′				
1885.							
May 23rd	*Glenochiel* .	7—6	77—0	N.-W. 2	29·80	86	.....
„ 24th	*Glenochiel* .	7—37	73—27	N.-W. 2	29·80	84	.....
„ „ .	*Baghdad* .	15—11	58—3	W.-S.-W. 2 to 3	30·00	...	Light wind, S.-W. swell.
„ „ .	*Royal George*	16—21	71—41	N.-N.-W. 3	29·93	...	.....
„ „ .	*Nianza* .	15—10	69—15	N.-N.-W.	...	...	Light wind, fine.
„ 25th	*Glenochiel* .	7—45	69—57	Variable	29·82	85	.....
„ „ .	*Baghdad* .	15—23	54—50	Calm	29·97	...	Light wind, S.-W. swell, very hot.
„ „ .	*Royal George*	15—7	72—18	N.-N.-W. 3	29·93	...	.....
„ „ .	*Nianza* .	12—17	65—30	N.-N.-E. 4	...	...	Moderate wind, fine.
„ 26th	*Glenochiel* .	7—42	66—27	S. 3 to 4	29·78	87	.....
„ „ .	*Baghdad* .	14—46	52—30	Calm	29·97	...	Light wind, S.-W. swell, very hot.
„ „ .	*Royal George*	14—22	72—32	Variable	29·90	...	.....
„ „ .	*Nianza* .	9—29	61—42	W.-S.-W. 4	...	...	Unsettled, heavy rain; squalls at times.
„ 27th	*Glenochiel* .	7—45	63—40	W. 6	29·74	84	A.M., dirty appearance to N.-W., but gradually receding, fierce squalls.
„ „ .	*Baghdad* .	14—17	50—47	Calm	29·93	...	Light wind, S.-W. swell, very hot.
„ „ .	*Royal George*	13—32	72—58	N.-N.-W. 3	29·93	...	.....
„ „ .	*Nianza* .	7—4	58—5	W.-S.-W. 5	...	...	A.M., wind fresh, sea getting up; P.M., heavy squalls.
„ „ .	*Sutlej* . .	18—6	69—7	W. 2	29·83	86	Light winds and fine.
„ 28th	*Glenochiel* .	7—45	61—20	W. 6.	29·86	82	Fierce squalls, very heavy rain, heavy sea.
„ „ .	*Baghdad* .	13—32	48—6	S.-E. 3	29·91	...	Light wind, S.-W. swell, very hot.
„ „ .	*Royal George*	13—13	72—54	E.	...	...	Heavy swell, bank of rain clouds S.-S.-W.
„ „ .	*Nianza* .	4—52	55—16	W.-S.-W. 5	...	...	A.M., severe squalls; P.M., fine.
„ „ .	*Sutlej* . .	16—58	63—36	W. 2	29·84	86	Light winds and fine.
„ „ .	*City of Venice*	17—58	69—8	W. 4	29·84	85	.....
„ 29th.	*Glenochiel* .	7—45	58—47	W.-N.-W. 8	29·72	82	Fresh gale, heavy sea.
„ „ .	*Baghdad* .	12—42	45—54	E. 3.	29·90	...	Light wind, S.-W. swell, very hot.
„ „ .	*Royal George*	12—45	72—59	N.-N.-W.	29·89	...	.....
„ „ .	*Nianza* .	2—51	51—45	W.-S.-W. 5	...	...	Cloudy.
„ „ .	*Sutlej* . .	15—55	58—10	W. 2	29·83	90	Light winds and fine; midnight, swell from S.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weathrr Remarks.
		° ′	° ′				
1885.							
May 29th	*City of Venice*	16—52	64—47	Variable	29·85	87	.....
,, 30th.	*Glenochiel* .	7—27	55—47	W. 4	29·71	84	.....
,, ,, .	*Baghdad* .	Aden.		N.-N.-W.	...	...	6 P.M., drizzling rain, squally E.-N.-E.
,, ,, .	*Royal George*	12—30	73—17	S.-S.-W.	29·89	...	.....
,, ,, .	*Nianza* .	0—43	48—1	W.-S.-W. 3	...	...	Light wind, fine.
,, ,, .	*Peshawar* .	8—40	61—10	W.-S.-W.	29·84	85	A.M. moderate wind; P.M. moderate wind, high S.-W. swell.
,, ,, .	*Northern* .	Off Aden.		Calm	...	...	Fine.
,, ,, .	*Sutlej* . .	14—40	53—0	W. 2	29·81	86	Light winds and fine.
,, ,, .	*City of Venice*	15—47	60—29	E.-S.-E. 2	29·80	88	.....
,, 31st.	*Glenochiel* .	8—48	55—33	W.-S.-W. 6	29·70	86	.....
,, ,, .	*Clan Graham*	13—24	48—13	S.-S.-W.	29·73	87	.....
,, ,, .	*Royal George*	11—38	73—55	N.-W.	29·89	...	Heavy bank of clouds to S.-W., vivid lightning all night.
,, ,, .	*Peshawar* .	10—56	57—46	W.-S.-W. 7	29·77	82	4 A.M. strong W. wind 29·78; 8 A.M. fresh gale, squalls; 4 P.M. moderate monsoon gale; 10 P.M. 29·75 rain squalls.
,, ,, .	*Northern* .	13—2	48—44	Calm	...	...	Fine.
,, ,, .	*Sutlej* . .	13—18	47—29	W. 2	29·77	88	Light winds and fine.
,, ,, .	*City of Venice*	14—42	55—59	N.-E. 4	29·76	86	Heavy clouds to E.; P.M. wind rising, lightning in E.
,, ,, .	*Inchulva* .	19—0	39—53	Variable	29·88	85	Fine.
,, ,, .	*Sahara* .	24—18	36—17	N. 5	30·23	86	.....
June 1st .	*Glenochiel* .	10—16	52—22	S.-W. 6	29·62	88	.....
,, ,, .	*Clan Graham*	14—27	52—13	E.-N.-E. 8	29·60	84	A.M. muchlightning in E., wind increasing; P.M. strong gale; midnight moderating.
,, ,, .	*Kaiser-i-Hind*	13—56	42—50	Variable	29·79	95	Light and fine.
,, ,, .	*Pharos* .	5—33	65—42	S.-W. 4	...	...	P.M., squally, lightning in N.-W.
,, ,, .	*Royal George*	10—40	74—52	N.-N.-W.	29·87	...	Squally, lightning; heavy ,, S.-S.-E., lightning all night.
,, ,, .	*Peshawar* .	13—53	54—50	E.-S.-E. 5	29·80	80	A.M., S.-S.-W. 5, fresh monsoon, rain; 8 P.M., 29·67, strong S.-E. gale.
,, ,, .	*Northern* .	14—26	52—5	N.-E. 6	...	...	A.M., rising S.-E. swell; P.M. very heavy sea, N.-E. 9.
,, ,, .	*Sutlej* . .	12—29	44—2	S.-W. 2	29·68	87	Light winds and fine.
,, ,, .	*City of Venice*	13—40	51—30	N. 5.	29·03	86	A.M., wind backing N., rain clouds to E.
,, ,, .	*Diomed* .	12—39	50—30	Variable	29·90	...	Fine; 8 P.M., heavy squall from E.-N.-E.; 10 P.M., strong gale; 11 30 P.M., hurricane, 29·05.
,, ,, .	*Inchulva* .	16—6	41—36	Ditto	29·92	89	Moderately cloudy, lightning; P.M., fine.
,, ,, .	I.M.S. *Lockwood.*	12—56	47—36	S.-W.	29·76	86	A.M., fine; P.M., dull; midnight, 29·66, N.-E. 4.
,, ,, .	*Lancelot* .	9—34	65—57	Variable	29·78	87	Midnight, strong N.-W. wind.
,, ,, .	*Knight of Thistle* . .	7—9	62—21	S.-W. 4	29·88	83	.....
,, ,, .	*Sahara* . .	21—16	38—11	N. 5	29·81	86	Fresh wind fine.

Storms Nos. 47 and 48.

Storms Nos. 47 and 48.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1885.		° ′	° ′				
June 1st .	*Duke of Devonshire* .	18—4	39—48	N.-N.-W.	29·79	88	Fine.
,, 2nd .	*Glenochiel* .	11—41	51—41	S. 5	29·58	88	.....
,, ,, .	*C. Graham* .	14—56	54—41	S.-E.	29·75	85	Wind moderating.
,, ,, .	*Kaiser-i-Hind*	12—47	45—17	W. 2 to 3	29·69	89	A.M., light wind, and fine; P.M. heavy rain, N.-E. 6, squally.
,, ,, .	*Pharos* .	7—8	66—20	N.-W. 4	...	...	A.M., heavy squalls; P.M., light breeze, cloudy.
,, ,, .	*Royal George*	8—39	74—45	S.	29·84	...	.....
,, ,, .	At Massowa.			...	...	...	Strong gale S.-E. to S.-W. on June 2nd.
,, ,, .	*Peshawar* .	13—10	49—35	N.-N.-E. 8 to 9	29·59	85	4 A.M., 29·57, E.-N.-E. 8, incessant heavy rain; noon, strong gale, heavy sea; P.M., continuous rain; 4 P.M., 29·62, N.-N.-E. 9; 8 P.M., 29·66, N.-N.-E. 5; midnight, W. 10, wind increasing, rain, every appearance of cyclone. Position at midnight, Lat. 12° 45′ N. Long. 47° 45′ E.
,, ,, .	*Northern* .	15—41	55—5	S. 7	...	...	A.M., strong wind, moderate S.-E. swell.
,, ,, .	*Sutlej* . .	16—15	41—15	N.-W. 3	29·71	92	Moderate winds and fine.
,, ,, .	*Tantallon* .	13—16	43—2	N.-W. 2	29·81	95	A.M., light N.-W. wind; 10 P.M., fresh N.-W. wind, increasing to gale, thunder and lightning.
,, ,, .	*City of Venice*	12—41	47—15	W. 2 to 3	29·57	88	A.M., dull cloudy weather, very dark with lightning in N.-E.; at noon clouds travelling from E.; 8 P.M. to midnight, strong unsteady N.-E. to N.-W. wind.
,, ,, .	At Aden.			N.-N.-W. 9	29·80	...	6 P.M., 29·75.
,, ,, .	*Diomed* .	...	...	...	...	...	A.M., wind still blowing hurricane; 8 P.M. gale moderating, barometer rising.
,, ,, .	*Inchulva* .	13—20	43—9	N.-W. 3	29·82	86	Fine; P.M. passed Perim; 8 P.M., N.-W. 5, squally.
,, ,, .	I. M. S. *Lockwood* . .	13—50	49—45	E. 12	29·46	91	A.M., dull, oppressive; 2 30 A.M., rain, N.-W. wind; 3 A.M., fearful gust from N.-W.; 8 A.M., terrific squalls; 11 A.M., wind veering eastward; noon, hurricane; 6 P.M. wind moderating; midnight, 29·76.

DATE.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	WEATHER REMARKS.
		° ′	° ′				
1885.							
June 2nd.	*Lancelot* .	11—14	67—12	W.	29·78	87	5 A.M., wind to E.; P.M., back to westward.
,, ,, .	*Knight of Thistle* .	9—10	63—40	N.-W. 4	29·86	85	Squally, showery throughout.
,, ,, .	*Sahara* .	17—59	40—7	W. 2	29·73	87	Light wind, hazy weather.
,, ,, .	*Cuba* . .	13—27	49—3	N.-E. 9	29·63	86	A.M., light breezes; 4 A.M. fresh gale; P.M., strong gale; 8 P.M. 29·45.
,, ,, .	*Duke of Devonshire* .	14—44	42—19	N.-W. 4	29·70	89	.....
,, ,, .	*Columbian* .	14—48	42—11	N. 4	30·00	...	Light wind, fair.
,, ,, .	*Assyria* .	25—32	57—50	S.	30·116	102	Light breezes.
,, 3rd.	*Glenochiel* .	12—44	50—7	S.-E. 4	29·72	86	P.M., light airs.
,, ,, .	*Clan Graham*	15—49	59—30	S. 3.	29·79	87	Light winds and fair.
,, ,, .	*Kaiser-i-Hind*	13—39	48—44	N--E.5.	29·78	83	A.M., strong easterly gale; P.M. wind decreasing.
,, ,, .	*Baghdad* .	Aden		N.-N.-W.	29·69	...	1 P.M., blew hard from N.-N.-W., 29·58.
,, ,, .	*Pharos* .	8—0	66—44	W.-N.-W.4	...	...	A.M., squally; P.M., squally, rainy.
,, ,, .	*Royal George*	8—6	75—14	W.	29·84	...	A.M., blowing furiously; 1 A.M. 29·40; 2 A.M. 29·37, W. 12; 2 45 A.M. 28·87, S. 12; 4 A.M. 29·10 S. 11; bar. commencing to rise; 8 A.M. 29·72.
,, ,, .	*Peshawar* .	12—21	46—55	W.5	29·78	84	
,, ,, .	*Northern* .	16—13	58—40	S.-W.5	...	...	.....
,, ,, .	*Sutlej* . .	20—39	38—7	N.-W.3	29·65	92	.....
,, ,, .	*Tantallon* .	12—20	45—50	N.-W. 7	...	...	1 A.M. wind and sea decreasing; 2 A.M. light breeze, wind shifted to S.-E.; 4 A.M. N.-W. again; 8 A.M. rain; 9 30 A.M. heavy squall, rain; 10 A.M. blowing a cyclone; 11 20 A.M. bar. lowest 27·86; 1 P.M. moderating.
,, ,, .	*City of Venice*	13—1	43—13	S.-E. to S.3	29·64	85	Light wind, heavy clouds to southward.
,, ,, .	At Aden.			N.-N.-W.9	29·78	...	9 A.M. N. 4; 10 A.M. N.-N.-W. 6, 29·85; noon N.-N. W. 9; 1 P.M. N.-N.-W. 10; 2 P.M. N. 12; 3 P.M. N.-E. 9; 4 P.M. 29·72, S.-E. 8; 5 P.M. S.-E. 5; 6 P.M. E. 5, 29·71; 7 P.M. N.-N.-E. 4.
, ,, .	*Diomed* .	...	...	...	...	...	10 30 A.M. 29·50, wind moderate, variable.
,, ,, .	*Balcarres Brook.*	Perim		...	...	...	Passed Perim 4 30 P.M.; at 6 P.M. very sudden violent gale; 10 P.M., complete hurricane from E.-N.-E.

Storms Nos. 47 and 48.

	Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
Storms Nos. 47 and 48.	1885.		° ′	° ′				
	June 3rd.	*Columbian* .	12—29	44—5	Calms	29·75	...	2 P.M. squally appearance in S.-E., observed heavy rollers travelling towards vessel from S.-E., at same time heavy squalls; 2 30 P.M. wind suddenly shifted to N.-E., striking ship, with cyclone force; 3 P.M. 29·60, terrific cyclone; 3 30 P.M. 29·50; 4 30 P.M. 29·26, wind at highest, E.-N.-E. 12; 4 40 P.M. 29·20; 5 P.M. wind E.; 5 30 P.M. E.-S.-E. 29·20; 6 P.M. 29·40, S.-E. moderating; 7 P.M. 29·60; 9 P.M. 29·86.
	,, ,,	*Inchulva* .	11—56	15—58	N.-E.12	28·92	96	A.M. N. 5 vivid lightning, hot airs with passing showers; 4 A.M. 29·62, swell from E.; 8 A.M. 29·32, very heavy swell from E.; 8 30 A.M. deluge of rain, 29·22; 9 A.M. N.-E. 7; 9 30 A.M. terrific squall from N.-N.-E., heavy rain; 10 A.M. N.-E. 12; 1 P.M. cyclone moderating, 28·72; 2 P.M. 28·52; 11 P.M. 29·12, moderate breeze.
	,, ,,	I. M. S. *Lockwood.*	14—4	52—13	S.	29·79	83	A.M. wind and sea taking off; P.M. light wind.
	,, ,,	*Lancelot* .	12—34	59—17	N.-N.-W.	29·77	87	A.M. cloudy; 2 P.M. wind S.-E., squally; 8 P.M. rain.
	,, ,,	*Knight of Thistle.*	11—15	55—27	N.-W.5	29·88	85	P.M. heavy squall from N.-W.
	,, ,,	*Sahara* .	15—3	42—6	S.-W.4	29·82	87	A.M. hazy weather; P.M. very thick, S.-W. gale.
	,, ,,	*Cuba* . .	14—17	50—56	E.3	29·78	88	Light wind, fair.
	,, ,,	*Duke of Devonshire*	Off	Aden.	N.12	29·43	...	A.M. squally, unsettled; 10 A.M. 29·63; 1 P.M. 29·136, wind increasing from N., violent rain, vivid lightning, wind veered to W., thence to S., and finally at 5 P.M. moderated at S.-E. Most violent storm ever experienced by Captain after 26 years at sea. Lowest barometer 28·93; time not given.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
		° ′	° ′				
1885.							*Storms Nos. 47 and 48.*
June 4th .	*Congo* . .	Aden		N.-E.8	29·205	...	P.M. wind veering N.-E., E., S.E., S., terrific hurricane.
,, ,, .	*Clare* . .	Off Aden		E.-N.-E.9	29·78	82	10 30 A.M. hard gale; P.M. hard gale.
,, ,, .	*Assyria* .	24—59	60—53	S.-W.	30·076	90	Light breezes.
,, ,, .	*C. Graham* .	16—45	63—45	N.-W.4	29·78	91	.....
,, ,, .	*Kaiser-i-Hind*	14—26	53—19	S..E.3	29·86	86	A.M. moderate breeze; P.M. light airs.
,, ,, .	*Bhandara* .	8—32	76—44	S.-S.-W.4	29·80	89	Cloudy weather, moderate breeze.
,, ,, .	*Baghdad*. .	Aden		E.	29·89	...	.....
,, ,, .	*Pharos* . .	8—34	67—7	N.-E.3	...	...	P.M. squally, rainy.
,, ,, .	*Royal George*	7—15	75—57	W.	29·84	...	Midnight strong breeze.
,, ,, .	*Northern* .	17—6	62—26	S.-W.4	...	...	Fine.
,, ,, .	*Tantallon* .	12—34	48—55	N.-E.3	29·86	89	.....
,, ,, .	*City of Venice*	16—48	41—2	S.-S.-E.4	29·76	88	Light wind.
,, ,, .	*Inchulva* .	12—22	45—26	Variable	29·83	87	Light wind, fine.
,, ,, .	I. M. S. *Lockwood*.	15—8	55—59	W.-S.-W.2 to 3	29·76	86	Fine.
,, ,, .	*Lancelot* .	13—42	69—36	Variable	29·76	85	A.M. wind N. again; thunder and lightning; P.M. light wind, cloudy.
,, ,, .	*Knight of Thistle*.	11—51	66—32	N.-W. 2 to 3	?29·89	84	A.M. vivid lightning, squalls from N.-W.; P.M. squally.
,, ,, .	*Sahara* .	12—33	43—33	S.8	29·78	89	A.M. strong gale, rain; P.M. moderating.
,, ,, .	*Duke of Devonshire*.	12—28	47—37	E.-N.-E.2	29·81	87	
,, ,, .	*Congo* . .	12—22	47—8	Variable	29·755	...	Fine.
,, ,, .	*Clare* . .	12—45	46—0	Do.	29·92	84	Light wind, fine.
,, ,, .	*Assyria* .	25—2	64—5	Do.	30·116	87	Light breeze; 8 P.M., sudden increase of bar: to 30·17; midnight 29·64, squally, E. wind.
,, 5th .	*C. Graham* .	17—42	68—10	N.-N.-W.4	29·72	98	.....
,, ,, .	*Benares* .	15—50	70—58	N.	...	...	Fine.
,, ,, .	*Bhandara* .	11—59	75—1	Calm	29·76	88	Fair, light winds.
,, ,, .	*Baghdad* .	Aden		Calm	29·87	...	.....
,, ,, .	*Pharos* .	9—4	67—37	N.	...	...	Squally, rainy.
,, ,, .	*Royal George*	6—10	76—55	S.-W.	29·83	...	Rain, thunder and lightning; midnight moderate gale.
,, ,, .	*Northern* .	17—31	66—2	Variable	...	...	Fine.
,, ,, .	*Tantallon* .	13—29	52—21	S. 3	29·81	94	.....
,, ,, .	*Teheran* .	Colombo		W. 3	29·81	85	.....
,, ,, .	*Inchulva* .	13—15	49—41	Variable	29·83	87	Light wind, fine.
,, ,, .	I. M. S. *Lockwood*.	15—38	59—14	W. 2 to 3	29·76	87	Light wind, fine.
,, ,, .	*Lancelot* .	14—7	69—20	N.-N.-E. 2 to 3	29·70 (?)	87	A.M. cloudy; P.M. light wind, fine, bar. falling.
,, ,, .	*Knight of Thistle*.	12—2	66—57	N.-N.-E. 2 to 3	29·92	85	A.M. fine weather; P.M. very squally.
,, ,, .	*Sahara* .	12—44	46—28	E. 1	29·83	95	Light wind and fine.
,, ,, .	*Sirdhana* .	12—31	74—50	N.-E. 3	29·80	81	Fine.
,, ,, .	*Duke of Devonshire*.	13—10	51—36	Variable	29·84	87	.....
,, ,, .	*Congo* . .	13—31	51—4	S.-W.	29·705	...	Fine.
,, ,, .	*Clare* . .	13—16	49—30	Variable	29·93	86	Fair.
,, ,, .	*Assyria* .	Karrachi		E.	29·69	84	.....
,, 6th .	*Benares* .	16—7	72—0	N.	29·65	...	A.M. fine; 11 P.M. very heavy rain, squalls from N.-E.

Storms Nos. 47 and 48.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
		° ′	° ′				
1885.							
June 6th .	*St. Bernard* .	21—52	68—48	Variable	29·61	90	A.M. light airs; P.M. light airs.
,, ,, .	*Bhandara* .	15—27	73—22	S.-W. 2 to 3	29·70	92	A.M. showers, light breezes; P.M. rain, hard squalls from N.-E. round by S. to N.-W.; 8 P.M. 29·70.
,, ,, .	*Baghdad* .	11—9	51—43	S. 2	29·83	...	10 P.M. wind fresh, S.-S.-W.
,, ,, .	*Pharos* .	9—32	67—31	W. 3	...	...	P.M. gale began; 8 P.M., strong gale.
,, ,, .	*Royal George*	5—6	77—45	S.-W. 8	29·83	...	Moderate gale; overcast.
,, ,, .	*Northern* .	18—7	69—41	Variable	...	...	Fine.
,, ,, .	*Tantallon* .	14—6	56—9	S. 2	29·86	95	Fine.
,, ,, .	*Inchulva* .	14—19	52—56	S.-W. 4	29·88	87	Light wind, fine.
,, ,, .	*Merka* . .	15—57	70—35	W. 6	29·62	...	.....
,, ,, .	I. M. S. *Lockwood*.	16—8	62—43	N.-N.-E. 3	29·80	85	Light wind and fine.
,, ,, .	*Lancelot* .	15—8	68—45	N.-N.-W. 5	29·70	88	.....
,, ,, .	*Knight of Thistle*.	12—18	68—4	N.-N.-E. 3	(?)29·65	87	Light wind, rain; P.M. heavy rain.
,, ,, .	*Sahara* .	13—24	49—46	W. 3	29·85	95	Light airs, fine.
,, ,, .	*Sirdhana* .	15—53	73 23	Light airs W.-S.-W.	29·70	83	P.M. squally, rainy.
,, ,, .	*Cuba* . .	17—24	61—26	N.	29·83	88	Light breezes, fair.
,, ,, .	*Duke of Devonshire*.	12—25	55—27	S.-W. 3	29·816	86	.....
,, ,, .	*Commilla* .	20—42	70—27	N.-W. 4	29·71	85	Light winds.
,, ,, .	*Congo* . .	14—39	55—16	S.-W.	29·905	...	Cloudy.
,, ,, .	*Clare* . .	14—22	53—33	Variable	29·95	86	Fair.
,, 7th.	*Benares* .	16—27	71—38	E.-N.-E.	29·61	...	A.M. squally; P.M. rain showers, heavy S.-W. swell.
,, ,, .	*St. Bernard* .	19—19	72—13	S.-E. 5	29·42	88	A.M. moderate breeze; P.M. increasing wind and sea, moderate gale.
,, ,, .	*Calder* . .	25—30	57—52	S.-S.-E. 2 to 3	29·72	91	Light breeze, fine.
,, ,, .	*Baghdad* .	8—8	51—43	S.-W. 8	29·91	...	5 A.M. wind S.-W. increasing.
,, ,, .	*Pharos* .	10—4	67—39	W. 9	...	...	Continuous strong gale.
,, ,, .	*Royal George*	3—53	79—9	W. 4	29·83	...	Moderate wind; clear.
,, ,,	*Tantallon* .	15—9	59—37	Calm	29·86	91	Fine.
,, ,, .	*Inchulva* .	15—25	56—22 (?)	S.-W. 3	29·80	91	Swell rolling up from S.-W.
,, ,, .	*Merka* .	12—53	68—43	W. 5	29·62	...	A.M. heavy rain, squally, dark, gloomy weather.
,, ,, .	I. M. S. *Lockwood*.	16—49	66—35	N. 4	29·74	85	A.M. fine; P.M. dull, wind veering.
,, ,, .	*Lancelot* .	15—41	69—46	N. 3	29·63	85	3 A.M. squally, rain; 8 P.M. 29·57, rain.
,, ,, .	*Knight of Thistle*.	13—16	69—35	W.-S.-W. 5	(?)29·71	87	8 A.M. 29·75, squally; midnight, gale.
,, ,, .	*Sahara* .	14—23	53—18	S.-W. 3	29·83	84	Light airs, fine.
,, ,, .	*Cuba* . .	18—16	65—13	N.	29·78	90	Moderate breezes, fair.
,, ,, .	*Duke of Devonshire*.	11—18	59—19	W.-N.-W. to S.-W. 3	29·82	86	.....
,, ,, .	*Commilla* .	23—42	66—10	E. 4	29·67	83	Moderate winds.
,, ,, .	*Congo* . .	15—40	58—50	N.-E.	29·705	...	Fair weather.
,, ,, .	*Clare* . .	15—20	57—15	W. 3	29·97	86	Fair.
,, ,, .	*Akuba* . .	18—39	72—6	E.-N.-E.	...	...	Squally, thunder and lightning.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1885.		° ′	° ′				
June 8th .	*Assyria* .	Off Karachi		S.-S.-W. 4	29·43	98	.....
,, ,, .	*Benares* .	18—11	72—11	E.-S.-E.	29·45	...	Strong increasing breeze, squally.
,, ,, .	*Calder* .	24—13	61—1	S. 2 to 3	29·64	88	Moderate winds, fine.
,, ,, .	*Baghdad* .	4—43	53—40	S.-W. 6	29·87	...	.....
,, ,, .	*Pharos* .	11—9	67—53	W.-S.-W. 9	...	...	Strong gale, squalls.
,, ,, .	? .	13—5	46—31	S.-W. 3	29·55	85	.....
,, ,, .	*G. Papua* .	14—24	50—59	S.-W. 3	29·68	96	.....
,, ,, .	*Tantallon* .	16—18	63—12	N.-W.	29·71	85	A.M. light winds, fine, cloudy; P. M. fresh breeze, thunder and lightning.
,, ,, .	*Teheran* .	8—26	76—42	N.-W. 2 to 3	29·83	81	Heavy squalls with rain.
,, ,, .	*Inchulva* .	15—59	59—32	W. 4	...	...	Moderate breezes, heavy swell.
,, ,, .	*Merka* . .	9—54	66—52	W. 8	29·52	...	.....
,, ,, .	I. M. S. *Lockwood*.	17—28	69—5	E.-N.-E. 6	29·51	85	A. M. dull, wind increasing, rain; P.M. wind and sea rising, squally; 8 P. M. 29·46; midnight E.-S.-E. gale.
,, ,, .	*Lancelot* .	15—34	69—36	N.-N.-E. 4	29·37 (?)	85	4 A.M. 29·46, wind S.-E; 8 P. M. 29·17, rain; 9 P. M. S.-W. 6; 10 P. M. S.-W. hurricane; midnight violent hurricane, S.-W., 29·07.
,, ,, .	*Knight of Thistle.*	16—18	72—9	S.-E. 8	29·82	85	A. M. rain; P. M. S. 6, squally.
,, ,, .	*Sahara* .	15—7	57—3	S.-W. 2	29·69	89	Cloudy all round, long swell from S.-W.
,, ,, .	*Satara* .	Off Bombay		...	...	...	P.M. squally appearance.
,, ,, .	*Cuba* . .	18—39	68—54	E.-N.-E.	29·55	88	A.M. light breeze; P.M. strong wind, squally.
,, ,, .	*Duke of Devonshire.*	10—10	63—16	W. 4	29·71	87	Squally, rainy.
,, ,, .	*Eastbourne* .	13—24	17—54	W.-S.-W. 3	...	...	Light wind and fine.
,, ,, .	*Comilla* .	24—19	67—4	N.-W. 2	29·59	89	Moderate wind.
,, ,, .	*Congo* . .	16—42	62—58	N.-W.	29·505	...	A. M. cloudy; P. M. constant rain.
,, ,, .	*Clare* . .	16—30	61—2	N.-W. 4	? 29·97	86	A. M. fair; P. M. cloudy, north-west fresh wind; midnight 29·83.
,, ,, .	*Columbian* .	13—9	46—34	W. 4	...	...	P.M. wind increasing.
,, ,, .	*Akubu* . .	17—56	69—4	N.-N.-W. 8	...	...	A.M. moderate east-north-east wind; 4 P.M. showers, north wind; 10 P.M. wind hauling to north-west, squally, strong gale.
,, ,, .	*Abana* . .	18—10	70—16	E. 5	29·73	97	P.M. frequent squalls, lightning.
,, ,, .	*Assyria* .	21—35	69—10	S.-E.	29·50	90	P.M. squally appearance; 8 P.M. 29·50, heavy south-east swell.
,, 9th .	*Calder* .	22—56	64—29	N.-W. 4	29·54	92	Moderate winds, fair;
,, ,, .	*California* .	14—52	54—48	S.-W. 2	29·73	87	P.M. swell from south-east; 8 P.M. 29·46.
,, ,, .	*City of Carthage*	14—8	51—38	S. 4	29·66	83	P.M. heavy south-west swell.

Storms Nos. 47 and 48.

Storms Nos. 47 & 48.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1885.		° ′	° ′				
June 9th .	*Pharos* .	11—48	68—23	W.-S.-W. 9	...	...	Strong gale, squalls.
,, ,, .	*R. Rubattino.*	14—0	51—12	S.-W. 5	29·50	85	P.M. wind increasing.
,, ,, .	*G. Papua* .	15—15	54—14	S.-W. 6	29·63	94	A.M. fresh breeze, fine; P.M. strong wind, thick weather.
,, ,, .	*Tantallon* .	18—0	65—58	N. 5	29·71	85	P.M. north to north-west strong wind, gale at 6 P.M.
,, ,, .	*Teheran* .	12—21	74—46	S. 7	29·71	92	A.M. variable light winds; P.M. fresh wind and rain.
,, ,, .	*Zambezi* .	18 -23	72—39	S. 5	29·53	85	A.M. moderate gale; P.M. moderate head gale, rain, high sea.
,, ,, .	*Inchulva* .	16—37	63—4	W. 4	29·47	96	A.M. moderate breeze, fine; P.M. fresh wind, dull.
,, ,, .	*Merka* . .	7—37	65—37	S.-W. 6 to 7	29·52	...	P.M. wind moderated.
,, ,, .	*Newnham* .	13—30	49—33	W.-S.-W. 5	...	...	Fine.
,, ,, .	I. M. S. *Lockwood.*	18—34	71—13	S.-E. 7	29·49	85	A.M. east-south-east 9; 4 A.M. 29·41; P.M. strong south-east wind.
,, ,, .	*Lancelot* .	15—49	69—57	W.-S.-W. 12	29·10	...	4 A.M. terrific hurricane; P.M. terrific hurricane; midnight 29·22.
,, ,, .	*Knight of Thistle.*	17—27	72—48	S.-W. 6	?29·87	85	Weather moderate.
,, ,, .	*Sahara* .	15—43	60—30	N.-W. 6	29·67	89	P.M. strong wind, rain, heavy swell.
,, ,, .	*Satara.* .	21—31	69—8	N.-W. 3	29·48	86	Light to moderate breezes; P.M. unsettled sky.
,, ,, .	*Cuba* . .	19—4	71—37	E.-S.-E. 6	29·45	85	A.M. strong, squally wind; P.M. squally.
,, ,, .	*Culna* . .	5—56	81—28	W. 4	29·78	83	.....
,, ,, .	*Duke of Devonshire.*	8—49	67—25	W. 6	29·72	87	Rain squalls.
,, ,, .	*Eastbourne* .	14—28	51—17	S.-W. 3	...	...	Light wind and fine.
,, ,, .	*Congo* . .	17—40	66—29	N.-W. to W. 9	29·305	...	A.M. strong gale north-west; P.M. strong gale west.
,, ,, .	*Clare* . .	17—9	65—9	N.-W. 5	29·60	82	A.M. lightning; noon rain; P.M. N.-W. 8, squally; 6 P.M. 29·53; midnight 29·43.
,, ,, .	*Columbian* .	13—35	49—32	W.-N.-W.	29·71	86	A.M. light wind, fine; P.M. light wind, fine.
,, ,, .	*Akubu* . .	17—22	67—41	N.-W. 9	...	...	A.M. gale increasing.
,, ,, .	*Abana* . .	16—47	67—6	W.-N.W.	29·63	91	4 A.M. 29·54, N.-N.-E. 9; 9 A.M. N.-W.; 8 P.M. 29·55, W. 9.
,, ,, .	*Athabasca* .	18—58	71—13	S.-S.-W. 8	...	...	.....
,, ,, .	*Arlieb* . .	15—47	61—15	W. 4	...	...	Fresh wind, overcast.
,, ,, .	*Assyria* .	19—49	71—42	S.-E. 9	29·50	86	Fresh to strong south-east gale, heavy south-east swell.
,, 10th .	*Gwalior* .	18—24	70—59	S.-S.-W. 7.	29·46	84	4 A.M. 29·50, south-west 7, squally, heavy sea; 8 P.M. 29·53, south-south-west 9, squally, rainy.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1885.		° ′	° ′				
June 10th.	*Calder* .	21—28	67—23	E.-N.-E. 8	29·44	86	A.M. increasing breeze; P.M. easterly gales; 8 P.M., 29·39.
,, ,, .	*California* .	15—32	59—0	S.-W. 4	29·62	88	A.M. strong south-west breeze; P.M. sea increasing.
,, ,, .	*City of Carthage.*	14—59	56—16	W.-S.-W. 6	29·63	84	A.M. fresh breeze; P.M. strong breeze.
,, ,, .	*Pharos* .	12—47	69—27	W.-S.-W. 9	...	...	Strong gale, squalls.
,, ,, .	*R. Rubattino*	14—50	55—35	S.-W. 7	29·40	83	Heavy sea, wind very strong.
,, ,, .	*G. Papua* .	16—1	58—9	S.-W. 7	29·53	95	4 A.M. S.-W. 6, heavy sea; P.M. thick weather.
,, ,, .	*Tantallon* .	19—10	67—0	N. 9	29·31	89	A.M. north-west heavy gale; P.M. less wind; 8 P.M. 29·16.
,, ,, .	*Teheran* .	16—15	73—4	S.-W. 7	29·63	86	A.M. strong wind, squally; P.M. moderate wind, fine.
,, ,, .	*Zambezi* .	16—0	72—57	S. 6 to 7	29·60	83	A.M. moderate to fresh gale, heavy sea; P.M. fresh wind.
,, ,, .	*Inchulva* .	16—37	64—34	W. 9	29·42	96	1 A.M. fresh gale, squally, rainy; 2 A.M. W. 9, lightning in north-east; 3. 30 A.M. hard gale, tremendous sea; 3 P.M. hard gale, terrific squalls; 6 P.M. gale increasing.
,, ,, .	*Merka* . .	4—57	64—8	S.-S.-W. 6	29·72	...	.....
,, ,, .	*Newnham* .	14—49	53—30	S.-W. 5	...	...	Midnight fresh south-west wind, heavy sea.
,, ,, .	*Nizam* .	13—22	48—52	S.-W. 3	29·85	93	Light wind, fine.
,, ,, .	*Lancelot* .	15—56	70—34	W.-S.-W. 10	...	...	1 A.M. 29·25; P.M. strong gale; 3 P.M. 29·26.
,, ,, .	*Sahara* .	16—37	64—1	S.-W. 9	29·53	87	A.M. strong south-west gale; P.M. strong gale; 8 P.M. 29·49.
,, ,, .	*Satara* .	Off Karrachi		N.-W. 4	29·51	86	.....
,, ,, .	*Sunbeam* .	Off Bombay		S.-S.-E. 8	29·54	...	.....
,, ,, .	*Culna* . .	6—23	79—9	W.-N.-W. 3	29·81	83	.....
,, ,, .	*Duke of Devonshire.*	8—6	71—43	W. 6	29·77	86	P.M. improving.
,, ,, .	*Eastbourne* .	15—27	55—18	W.-S.-W. 4	...	...	Moderate breeze, fine.
,, ,, .	*Congo* .	18—8	68—9	S.-W. 9	29·005	...	A.M. strong gale, constant rain; P.M. terrific hurricane; 8 P.M. 29·055.
,, ,, .	*Clare* . .	18—8	68—5	S.-S.-W. 9	29·43	80	4 A.M. 29·38 N.-N.-W. 9; P.M. hurricane east to south-south-west; 6 P.M. 29·33; midnight 29·026(?).
,, ,, .	*Columbian* .	14—30	53—1	S.-S.-E.	29·71	88	A.M. light wind, fair; P.M. fresh south-west wind, bar. 29·63.
,, ,, .	*Akubu* . .	17—10	65—51	W.-N.-W. 11	...	...	Gale terrific all day.

Storms Nos. 47 & 48

Storms Nos. 47 & 48.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1885.		° ′	° ′				
June 11th.	*Abana* . .	16—0	66—36	W.-S.-W.	29·61	84	4 A.M. 29·54, westerly strong gale; P.M. improving; 8 P.M. 29·66.
,, ,, .	*Athabasca* .	18—58	68—15	N.-E. 9	...	...	A.M. south-east wind; P.M. N.-W. 6.
,, ,, .	*Arlieb* . .	16—4	64—57	W. 7	...	...	A.M. fresh monsoon; 3 P.M. sudden squalls; 4 P.M. westerly hurricane.
,, ,, .	*Gwalior* .	17—49	68—43	S.-S.-W. 9	29·51	83	4 A.M. 29·48, S.-S.-W. 10, violent squalls, mountainous sea; 8 P.M. 29·46, sea unchanged.
,, ,, .	*P. Horton* .	4—1	55—38	S.-S.-W. 5	29·85	...	.....
,, ,, .	*Calder* . .	20—55	68—20	S.-E. 8	29·48	86	A.M. fresh gales, heavy south-east swell; 8 P.M. 29·50.
,, ,, .	*California* .	17—0	63—16	W.-S.-W. 5	29·57	86	A.M. fresh S.-W. monsoon; P.M. fresh gale; 8 P.M. 29·37.
,, ,, .	*City of Carthage.*	16—0	60—29	W.-S.-W. 7	29·56	85	A.M. strong breeze, heavy sea; P.M. wind increased to gale.
,, ,, .	*Pharos* . .	13—7	70—4	W.-S.-W. 9	...	...	Strong gale, squalls.
,, ,, .	*R. Rubattino*	16—18	61—42	S.-W. 8	29·40	83	Bad weather, squalls and rain,
,, ,, .	*G. Papua* .	16—1	61—36	W.-S.-W. 7	29·43	...	A.M. strong wind, heavy sea; P.M. gale and tremendous sea.
,, ,, .	*Tantallon* .	18—37	69—34	S.-W. 5.	29·61	91	.....
,, ,, .	*Zambesi* .	13—3	74—14	S. 5	29·73	82	A.M. fresh wind; P.M. moderate wind; rain and lightning.
,, ,, .	*Inchulva* .	16—26	66—24	S.-W. 9	...	...	A.M. S. W. 9; midnight moderating.
,, ,, .	*Merka* . .	2—18	62—13	S.-W. 6	29·82	...	Wind moderating.
,, ,, .	*Newnham* .	15—11	56—57	S.-W. 9	29·25	...	A.M. strong S.-W. gale; 8 P.M. gale continues.
,, ,, .	*Nizam* .	14—17	53—58	S.-W. 6	29·60	86	P.M. fresh monsoon.
,, ,, .	*Lancelot* .	17—45	71—34	S.-W. 8	29·32	...	Moderating.
,, ,, .	*Sahara* . .	17—26	67—50	S.-W. 8	29·53	85	A.M. strong gale; P.M. strong gale, hard squalls.
,, ,, .	*Sunbeam* .	17—24	71—33	S. 7	29·85	...	A.M. gale and squalls; P.M. gale.
,, ,, .	*Culna* . .	8—1	77—18	W. 4	29·80	82	All day squally, showery.
,, ,, .	*Duke of Devonshire.*	7—43	76—1	W. 3	29·82	86	Fine.
,, ,, .	*Eastbourne* .	16—31	58—54	W.-S.-W. 4	...	...	Moderate breeze, fine.
,, ,, .	*Congo* . .	17—11	70—30	S.-W. 9	29·405	...	A.M. strong gale; P.M. fresh breeze.
,, ,, .	*Clare* . .	18—25	70—43	S. 6	29·43	84	1 A.M. 28·83 (?); P.M. moderating.
,, ,, .	*Columbian* .	15—13	56—28	S.-S.-W.	29·61	88	A.M. fresh wind, high sea; P.M. light breeze, heavy sea.
,, ,, .	*Akubu* . .	16—42	64—56	W. 11	...	...	Strong gale.
,, ,, .	*Abana* . .	15—32	65—43	S.-W.	29·672	...	4 A.M. 29·61, moderating; 8 P.M. 29·66, heavy squalls.

Date,	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
		° ′	° ′				*Storms Nos. 47 & 48.*
1885.							
June 12th.	*Athabasca* .	18—36	65—38	E.-N.-E. 8	...	...	A.M. N.-W. 6; P.M. gale, mountainous sea: gale began E. round N. to W. Bar. 3-55 P.M. 28·90 4-5 ,, 28·60 4-20 ,, 28·70 4-30 ,, 29·00
,, ,, .	*Arlieb* . .	16—56	68—57	S.-W. 9	...	...	Gale moderating.
,, ,, .	*Gwalior* .	17—21	66—31	S.-S.-W. 8	29·54	84	4 A.M., S.-S.-W. 8, 29·47; 8 P.M. 29·49 S.-W. 8.
,, ,, .	*P. Horton* .	6—35	57—35	S.-S.-W.	29·80	...	.....
,, ,, .	*Calder* .	20—18	70—17	S.-S.-W. 6	29·66	86	A.M. fresh gale, heavy sea, S.-E. swell; P.M. strong breeze.
,, ,, .	*California* .	17—47	67—2	S.-W. 5	29·50	85	A.M. fresh S.-W. monsoon; P.M. light wind.
,, ,, .	*City of Carthage.*	16—46	64—52	S.-W. 8	29·46	85	A.M. fresh S.-W. gale, lightning to eastward; P.M. moderating.
,, ,, .	*Pharos* .	13—48	70—4	S.-W. 7	...	..	A.M. moderating; P.M. moderate breeze.
,, ,, .	*R. Rubattino*	17—14	66—10	S.-W. 6	29·45	85	Moderating.
,, ,, .	*G. Papua* .	17—5	65—13	S.-W. 8	29·43	...	1 A.M. W.-S.-W. 10; 8 A.M. gale slightly abating; P.M. gale moderating.
,, ,, .	*Zambezi* .	9—23	76—15	N. 2 to 3	29·76	80	A.M. moderate wind, squally, rain; P.M. N.-W. light wind, thunder and lightning.
,, ,, .	*Inchulva* .	17—43	69—47	S.-W. 6	29·66	90	A.M. moderating; P.M. fine.
,, ,, .	*Newnham* .	15—37	60—40	S.-W. 9	...	...	Gale all day.
,, ,, .	*Nizam* .	15—1	58—53	S.-W. 7	29·57	86	Fresh to strong gale.
,, ,, .	*Sahara* .	18—24	71—24	S. 5	29·73	86	A.M. strong gale, noon wind, and sea going down.
,, ,, .	*Satara* .	25—0	63—52	E.-N. E. 4	29·50	85	A.M. light breezes; P.M. fresh E. wind, heavy cross sea.
,, ,, .	*Sunbeam* .	15—21	70—54	S. S. W. 7	29·72	...	All day strong wind, high sea.
,, ,, .	*Culna* . .	9—54	75—52	N. 2 to 3	29·79	81	Squally.
,, ,, .	*Eastbourne* .	17—51	62—30	W. S. W. 9	29·116	...	4 A.M. wind and sea increasing; 8 A.M. strong S.-W. gale; P.M. hard gale, heavy squalls.
,, ,, .	?	23—49	65—10	S. S. E. 6	29·55	85	P.M. increasing wind; 8 P.M. 29·501.
,, ,, .	*Comilla* .	22—55	68—30	S. S. E. 5	29·59	87	4 A.M. increasing wind, 29·48; P.M. fresh wind, heavy S.-E. swell.
,, ,, .	*Columbian* .	15—58	59—31	S. W.	29·57	86	A.M. fresh wind; P.M. strong S.-W. gale, overcast.
,, ,, .	*Akubu* . .	16—23	63—52	W. 10	...	...	Strong gale.
,, ,, .	*Abana* . .	16—27	64—56	S. W.	29·71	...	4 A.M. 29·70 S.-W. terrific squalls; P.M. moderate gale.

Storms Nos. 47 & 48.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weatherr Remarks.
1885.		° ′	° ′				
June 13th.	*Athabasca* .	18—33	64—46	S. W. 10	...	...	Strong cyclone.
,, ,, .	*Gwalior* .	17—16	63—31	S. W. 8	29·68	79	4 A.M. S.-W.7, 29·57; 8 P.M. 29·60 S.-W. 8.
,, ,, .	*P. Horton* .	9—22	60—7	S. S. W. 6	29·80	...	.....
,, ,, .	*G. Papua* .	18—52	68—38	S. W. 4	29·68	...	1 A.M. 29·58, S. 4; P.M. light breeze.
,, ,, .	*Zambesi* .	6—18	78—51	S. W. 3 to 5	29·81	79	A.M. moderate wind.
,, ,, .	*Newnham* .	16—13	64—0	S. W. 8	...	...	Decreasing gale.
,, ,, .	*Nizam* .	16—17	63—43	S. S. W. 8	29·67	85	Fresh monsoon gale.
,, ,, .	*Satara* .	25—17	59—44	E. N. E. 4	29·51	88	Moderate wind; overcast.
,, ,, .	*Sunbeam* .	13—1	69—45	S. S. W. 7	29·77	...	Strong wind.
,, ,, .	*Culna* . .	12—19	74—55	N. N. W. 3	29·82	79	Heavy squalls, N.-W. swell.
,, ,, .	*Eastbourne* .	18—38	66—19	S. W. 2	...	...	A.M. moderating; P.M. light wind.
,, ,, .	? .	22—18	63—5	S. 5	29·59	82	All day squally, heavy sea.
,, ,, .	*Commilla* .	20—44	70—32	S. W. 4	29·66	84	Moderate S.-W. monsoon.
,, ,, .	*Columbian* .	17—8	62—45	S. W.	29·62	84	A.M. fresh gale; P.M. moderating.
,, ,, .	*Akubu* .	16—17	62—53	W. S. W. 8	...	...	Gale moderating.
,, ,, .	*Abana* . .	16—40	62—52	S. S. W.	29·68	89	8 A.M. 29·68 S.-S.-W. 6; P.M. strong monsoon.
,, ,, .	*Athabasca* .	18—22	63—43	S. 7	...	...	Moderate gale.
,, 14th.	*Gwalior* . .	17—20	60—13	S. W. 8	29·61	83	4 A.M. 29·67; 8 P.M. 29·60, S.-W. 7.
,, ,, .	*P. Horton* .	11—43	62—38	S. W. 4	29·80	...	.....
,, ,, .	*Nizam* . .	17—42	63—34	W. S. W. 2	29·77	87	Light wind, fine.
,, ,, .	*Sunbeam* .	10—29	68—33	W. 5	29·81	...	P.M. moderating.
,, ,, .	*Culna* . .	14—38	73—54	W. S. W. 5	29·82	77	Heavy squalls, N.-W. swell.
,, ,, .	? .	20—50	61—23	S. 4	29·63	78	Moderate wind, sea going down.
,, ,, .	*Columbian* .	17—55	66—10	S. W.	29·73	87	A.M. moderate breeze; P.M. light airs.
,, ,, .	*Abana* .	17—2	60—16	S. S. W.	29·75	85	5 A.M. 29·73, fresh monsoon.
,, ,, .	*Athabasca* .	18—14	61—33	S.-W. 5	...	...	Squally weather.
,, 15th.	*Gwalior* .	16—32	56—42	S.-W. 7	29·69	85	.....
,, ,, .	*Sunbeam* .	8—24	66—26	W.-S.-W. 5	29·85	...	P.M. strong wind; high head sea.
,, ,, .	*Culna* . .	17—3	73—12	S.-E. 4	29·73	78	Heavy squalls.
,, ,, .	? .	18—50	60—40	S.-W. 5	29·61	81	4 A.M. 29·61; 8 P.M. 29·58, high sea.
,, ,, .	*Columbian* .	18—30	69—34	S.-W. 4	29·72	92	Fine.
,, ,, .	*Abana* . .	17—7	57—30	S.-S.-W. 5	29·81	83	Moderate monsoon.
,, ,, .	*Athabasca* .	17—55	59—19	S.-S.-W. 6	...	...	Strong south-west winds throughout.
,, 16th.	*Gwalior* .	15—43	53—15	S.-W. 6	29·70	83	.....
,, ,, .	*Sunbeam* .	7— 1	64—31	W.-S.-W. 6	29·86	...	High wind; very heavy sea.
,, ,, .	? .	17—54	58—36	W.-S.-W. 6	29·58	81	.....
,, ,, .	*Athabasca* .	17— 8	57—0	S.-S.-W.	...	...	Light wind.
,, 17th.	*Gwalior* .	14— 9	49—18	S.-W. 3	29·70	85	.....
,, ,, .	*Sunbeam* .	6—25	62—11	W.-S -W. 7	29·87	...	High wind; very heavy sea.
,, ,, .	? .	16—45	56—54	W.-S.-W. 5	29·60	85	.....
,, 18th.	*Sunbeam* .	6—15	60—1	W. 7	29·86	...	High wind; very heavy sea.
,, ,, .	? .	15—58	55—18	W.-S.-W. 5	29·67	82	Sea going down.
,, 19th.	*Sunbeam* .	6—55	57—39	W. 7	29·90	...	High wind; very heavy sea.
,, ,, .	? .	15—23	53—2	S.-W. 5	29·65	81	.....

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
		° ′	° ′				
1885.							
June 20th	*Sunbeam* .	8—10	55—37	S.-W. 8	29·92	...	High wind; very heavy sea.
,, 21st	*Do.* . .	9—39	53—11	S.-W. 7	29·85	...	High wind; very heavy sea; midnight gale.
,, 22nd	*Do.* . .	12—2	50—54	S.-S.-W. 7	29·77	...	Wind and sea decreasing.

Storms Nos. 47 & 48.

Storm No. 48.—This storm was generated off the west coast of India about June 5th, 1885, and travelled thence to the entrance of the Persian Gulf, which it reached about the 13th. The Aden cyclone had scarcely ceased to affect the weather before a fresh depression began to form off the west coast of India. Even on the 3rd, when the Aden cyclone was off that town, there existed an abnormal amount of northing in the winds over the Arabian Sea, and the barometer on the west coast of India was below the average. On the 4th the two ships nearest to the region over which the storm subsequently formed were the *Lancelot* in Lat. 13° 42′ N. and Long. 69° 36′ E.. and the *Knight of the Thistle* in Lat. 11° 51′ N. and Long. 66° 32′ E. Both these ships had winds from the north of west, with lightning and squalls. The *Pharos*, in Lat. 8° 34′ N. and Long. 67° 7′ E., had a squally north-east wind, and the *Bhandara*, in Lat. 8° 32′ N, and Long. 76° 44′ E., had a south-south-west wind and cloudy weather. These observations show that there existed, even at that early date, a low barometer off the west coast, with very abnormal wind directions. On the 5th these conditions had intensified. The barometer was 0·1″ below the average on the Malabar coast, and relatively to the average still lower off that coast. The wind on the *Lancelot* (Lat. 14° 7′ N., Long. 69° 20′ E.) had shifted to north-north-east; on the *Knight of the Thistle* (Lat. 12° 2′ N., Long. 66° 57′ E.) to north-north-east; and on the *Pharos* (Lat. 9° 4′ N., Long. 67° 37′ E.) to north, with squally and rainy weather. The winds on the west coast of India were still unaffected by the disturbed weather, but the marine observations are sufficiently conclusive evidence that a large diffused depression existed over the sea to the west of the Peninsula, with a centre approximately in Lat. 12° N. and Long. 71°. E. By the 6th the winds in the southern part of the west coast had shifted round to south-east and south, but the barometer had not changed much, the abnormals in that region being much the same as on the preceding day. The wind was northerly all over the centre of the Arabian Sea north of Lat. 10° N. and was south-west to the south of that latitude. The barometer on board the *Knight of the Thistle* had fallen 0·27″, but the wind was still light, though there was heavy rain.

Storm No. 48. June 1885. Pl. L.

June 3rd. Abnormal amount of northing in the winds over the Arabian Sea.

June 4th.

June 5th.

Winds on west coast India unaffected.

June 6th winds on west coast shifted to south. Winds still northerly over Arabian Sea.

Storm No. 48. Position of centre. June 7th.

The *Pharos* had a westerly gale in the evening and the *Royal George* a moderate south-west gale all day. The centre, so far as it can be determined, was still in Lat. 12° N. and Long. 71° E. The chart of the 7th showed that the storm had commenced a decided northerly movement. The barometer was largely below the average on the Bombay coast, with well marked cyclonic winds. The centre of the disturbance is determined by the observations recorded on the *Benares* (Lat. 16° 27′ N., Long. 71° 38′E.), which had an east-north-east wind, a falling barometer, rain, and a heavy south-west swell, the *Lancelot* (Lat. 15° 41′ N., Long. 69° 46′ E.), which had a northerly wind, a falling barometer, and squalls of rain; and the *Knight of the Thistle*, which had a west-south-west wind strong to a gale, a rising barometer, and heavy squalls. According to these observations the centre lay in Lat. 14° 30′ N. and Long. 71° 5′ E., having advanced 3° to the northward of the position it occupied on the 6th (203 miles). On the 8th the disturbance had developed into a well-marked storm, but had changed its position a little to westward. The barometer was more than 0·2″ below the normal on the Bombay coast, and the barometric deficiency over the neighbouring sea was even greater. Thus, the barometer readings on the following ships on the 7th and 8th were as follow:—

June 8th disturbance developed.

	7th.	8th.	Fall.
Lancelot	29·63	29·37	. 0·26″
I. M. S. *Lockwood*	29·74	29·51	. 0·23″
Cuba	29·78	29·55	. 0·23″

The position of the centre on the 8th was Lat. 15° 15′ N., Long. 70° 13′ E., and was determined by the observations recorded on the following ships:—

The *Lancelot* (Lat. 15° 34′ N., Long. 69° 36′ E.) had, at noon, a moderate north-north-east wind and a briskly falling barometer (29·37″). By 8 P.M. the barometer had fallen to 29·17″, with heavy rain and a south-west wind. By 10 P.M. there was a south-west hurricane, and by midnight a violent hurricane from south-west, with the barometer marking 29·07″.

The *Knight of the Thistle* (Lat. 16° 18′ N., Long. 72° 9′ E.) had a south-east gale, with heavy rain and squalls.

The I. M. S. *Lockwood* (Lat. 17° 28′ N., Long. 69° 5′ E.) had an east-north-east wind at noon, which by midnight had increased to a gale from east-south-east.

The weather all over the Arabian Sea was now affected by the disturbance, and the barometer was falling generally.

June 9th lowest bar. 29·10″.

On the 9th the centre was close to the *Lancelot*, which lay in Lat. 15° 49′ N., Long. 69° 57′ E., with a west-south-west hurricane and the barometer marking 29·10″. The storm had consequently begun to move north-westward. Gales were reported by the *Pharos* (W.-S.-W, 9) in Lat. 11° 48′ N., Long. 68° 23′ E. and (N.-W. 8) in Lat. 18° 0′ N.,

Storm No. 48.

Long. 65° 58′ E.; by the I. M. S. *Lockwood* (E.-S.-E. 9) in Lat. 18° 34′ N., Long. 71° 13′ E.; the *Congo* (N.-W. to W. 9) in Lat. 17° 40′ N., Long. 66° 29′ E.; by the *Akubu* (N.-W. 9) in Lat. 17° 22′ N., Long. 67° 41′ E.; by the *Abana* (N.-N.-E. 9 to W. 9) in Lat. 16° 47′ N., Long. 67° 6′ E.; and by the *Assyria* (S.-E. 9) in Lat. 19° 49′ N., Long. 71° 42′ E.

June 10th. Position of centre. Lowest bar. 29·00″.

The chart of the 10th showed that the centre had continued to progress north-westward, and at noon on that day lay in Lat. 18° 30′ N. and Long. 67° 20′ E. The ship nearest to the centre was the *Congo*, with the barometer reading 29·005″ and a south-westerly hurricane. Between Lat. 12° N. and Lat. 21° N., in the western half of the Arabian Sea, strong gales were experienced, and between Lats. 17° and 19° N. and Longs. 64° and 70° E. the hurricane was terrific.

June 11th. Position of centre.

On the 11th the centre of the storm was apparently in Lat. 18° 50′ N. and Long. 65° 15′ E., having travelled west-north-westward. The nearest ship to the centre was the *Athabasca* (Lat. 18° 36′ N., Long. 65° 38′ E.), which had an east-north-east gale and mountainous sea. The gale commenced at east and backed through north to west, so that the ship passed round the west side of the storm. No barometer reading was recorded at noon, but at—

3 55	P.M. the pressure was	28·90″
4 5′	,, ,, ,,	28·60″
4 20′	,, ,, ,,	28·70″
4 30′	,, ,, ,,	29·00″

All the ships between Lats. 16° and 20° N. and Longs. 62° and 72° E. had moderate to strong gales. To the north of the depression the only ships were the *Athabasca* (noticed above) and the *Calder*, which in Lat. 20° 55′ N. and Long. 68° 20′ E., had a south-east gale, with a heavy south-east swell.

June 12th.

On the 12th there were no ships in the neighbourhood of the centre, the position of which has consequently been determined by estimation from the logs of the *Athabasca*, the *Papua* and the *Eastbourne*. The positions of these vessels were as follows:—

	N. ° ′	E. ° ′			
Athabasca .	18—33	64—46	S.-W. 10	...	Strong cyclone.
Papua . .	17—5	65—13	S.-W. 8	29·43″	Gale moderating.
Eastbourne .	17—51	62—30	W.-S.-W. 9	29·12″	Wind and sea rising.

Position of centre.

From these observations the storm centre is calculated to have been in about Lat. 19° N. and Long 63° E., so that the motion had continued west-north-westward. Strong westerly to south-westerly gales were felt all over the region bounded by Lats. 16° and 19° N. and Longs. 58° and 68° E. To the northward of the centre there is little or no information, but the *Satara* in Lat. 25° 0′ N., Long. 63° 52′ E had only E.-N.-E. winds force 4, and the *Comilla* in Lat. 22° 55′ N. and Long. 68° 30′ E. had S.-S.-E winds force 5. On this day the storm was evidently

June 13th.

filling up; and after noon on the 13th it had practically disappeared, though it had left a strong monsoon blowing over the Arabian Sea.

Storm No. 48.
Position of centre, and rate of motion each day.

The following table shows the position and rate of motion of the storm :—

Date.	Position of Centre.		Direction of motion.	Distance travelled since noon of previous day.	Rate per hour.
	Latitude N.	Longitude E.			
1885.	° ′	° ′		Miles.	Miles.
June 7th	14—30	71—5	...	...	...
„ 8th	15—15	70—13	N.-W.	76	3·0
„ 9th	16—40	69—2	N.-N.-W.	123	5·0
„ 10th	18—30	67—20	N.-W.	167	7·0
„ 11th	18—50	65—15	W. by N.	145	6·0
„ 12th	19—15	63—5	W. by N.	145	6·0
„ 13th	20—30	59—27	W. by N.	254	10·6

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Storm No. 49.—Between May 24th and 29th, 1886, a gale occurred over the central parts of the Arabian Sea, but the information available is very slight, and derived from three ships only. The following are the logs of these ships :—

Storm No. 49.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1886.		° ′	° ′				
May 24th	*Caithness* .	6—10	60—20	W.-N.-W. 10	29·81	...	Squally.
„ 25th	*Do.* .	9—44	62—30	W.-N.-W. 5	29·83	...	.....
„ 26th	*Do.* .	12—28	64—19	W. 8	29·74	...	.....
„ 27th	*Do.* .	15—7	67—11	S.-W. 9	29·66	...	Wind backed to S.
„ 28th	*Do.* .	16—55	69—23	S. 4	29·96	...	.....
„ 29th	*Do.* .	18—26	71—59	S.	29·76	...	Fine.
„ 26th	*Akola* . .	17—1	71—21	S.-E. 5	...	...	P.M. wind and sea rising from S.-E.; 8 P.M. hurricane from E.-S.-E.
„ 27th	*Do.* . .	15—50	69—38	E.-S.-E. 8	...	...	Stormy.
„ 28th	*Do.* . .	18—0	71—6	S.-E. 8	...	...	Moderating.
„ 24th	*Errant* .	14—13	52—46	S. variable	30·19	86	Hot, sky overcast.
„ 25th	*Do.* . .	14—7	57—12	S.-W. 5	? 30·10	86	A.M. high wind.
„ 26th	*Do.* . .	15—50	60—45	S.-W. 5	? 30·20	88	Dull, sultry.
„ 27th	*Do.* . .	16—52	64—55	N. 7	? 30·10	86	P.M. dull, squally; 9 P.M. slowed engine, high confused sea, N.-N.-E. wind.
„ 28th	*Do.* . .	17—27	68—17	S.-W. 7	? 29·92	84	4 A.M., S.-W. 9; P.M. improving.
„ 29th	*Do.* . .	18—53	72—42	S.-W. 4	? 29·95	86	Fine.

Storm No. 49. May 24th.

The first intimation of the gale is afforded on the 24th by the *Caithness* in Lat. 6° 10′ N., Long. 60°20′ E., which experienced a west-north-west gale, with very heavy squalls. This ship was travelling north-eastward on a course apparently parallel to the storm and at about the same rate. On the 25th this vessel had still a west-north-west fresh wind and a steady barometer. On the 26th the ship approached much nearer the storm, and on that day—

May 25th.

May 26th.

	Lat. N.	Long. E.	
	° ′	° ′	
The *Caithness* in	12—28	64—19	had a westerly gale.
The *Akola* . in	17—1	71—21	„ south-easterly increasing wind.
The *Errant* . in	15—50	60—45	„ south-west fresh breeze.

On this day the centre was consequently in about Lat. 14° 20′ N., Long. 66° 15′ E.

May 27th.

On the 27th the barometer was falling quickly. The *Caithness*, in Lat. 15° 7′ N. and Long. 67° 11′ E., had a south to south-west hurricane; the *Akola*, in Lat. 15° 50′ N., Long. 69° 38′ E., had an east-south-east hurricane; and the *Errant*, in Lat. 16° 52′ N., Long. 64° 55′ E., had a northerly gale: hence, on this day the centre was probably in Lat. 16° 20′ N. and Long. 66° 20′ E.

After this time there is no clear trace of the storm. The centre apparently crossed the path of the *Errant*, as the wind, which had formerly been northerly with this ship, shifted suddenly to south-west in a hard gale, after which the weather improved.

Position of centre, and rate of motion each day.

The following table shows the position of the centre on the dates assigned and rate of motion of the storm:—

Date.	Position of Centre. Latitude N.	Position of Centre. Longitude E.	Direction of motion.	Distance travelled since noon of previous day.	Rate per hour.
				Miles.	Miles.
1886.	° ′	° ′			
May 24th	7—30	62—20	...	...	...
„ 25th	10—20	65—12	N.-E. by N.	261	10·9
„ 26th	14—20	66—15	N. by E.	290	12·0
„ 27th	16—20	66—20	N.	145	6·0
„ 28th	19—32	65—30	N. by W.	225	9·4

Storm No. 50. November 1886. Pl. LIII. *Reference*—Indian Meteor. Mem. Vol. IV, page 173.

Storm No. 50.—This storm began to form on the 2nd or 3rd of November 1886 in the neighbourhood of the Andamans. The centre crossed the Coromandel coast a little to the north of Madras about midday of the 9th, and the west coast of the Peninsula, between Ratnagiri and Karwar, on the afternoon of the 10th. Full details of this cyclone are given in Vol. IV of the Meteorological Memoirs.

Storm No. 50.

The following are the observations on which the various positions of the centre have been determined:—

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1886.		° ′	° ′				
Nov. 10th.	*Golden Horn*	12—6	74—50	S.-W.	29·83	...	Light winds and squally; heavy rain.
,, ,, .	*Sierra Pedrosa.*	12—34	74—34	N.-W.	29·80	...	Thick overcast weather and heavy rain.
,, ,, .	*Trossachs* .	12—36	74—12	Variable	29·83	...	Rain; dark threatening weather, heavy swell.
,, ,, .	*Gelert* .	13—52	74—12	N.-W.	29·76	...	Fresh wind, with dull gloomy weather and drizzling rain.
,, ,, .	*Waverley* .	16—51	63—39	N.-E. by E.	29·90	...	Fine clear weather; moderate breeze.
,, ,, .	*Atrato* .	17—21	63—54	N.-E. 4	...	...	Fine clear weather, smooth sea.
,, ,, .	*Madura* .	18—14	72—48	N.-N.-W.	29·85	...	Moderate breeze, fine weather, sky overcast.
,, ,, .	*Java* .	21—5	69—13	N.	29·95	...	Moderate winds and fine.
,, 11th	*Akbar* .	7—32	77—46	Calm	29·99	...	Fine clear weather.
,, ,, .	*Golden Horn.*	13—52	73—58	S.	29·93	...	Moderate wind and cloudy.
,, ,, .	*Sierra Pedrosa.*	13—59	73—20	S.	29·90	...	.....
,, ,, .	*Trossachs* .	14—51	73—7	S.-S.-E.	29·90	...	Fresh breeze, with cloudy weather and light showers of rain.
,, ,, .	*Gelert* .	16—43	73—2	S.-E.	?	..	Dark gloomy weather, fresh winds.
,, ,, .	*Waverley* .	17—26	66—43	N.-E.	29·88	...	A.M. moderate winds, clear weather; 4 P.M. moderate winds, with passing showers.
,, ,, .	*Peshwa* .	17—38	72—48	S.-E. 6	29·85	...	Sky overcast, showery; rising sea.
,, ,, .	*R Rubattino*	18—13	69—24	E.-N.-E.	...	...	Sea smooth.
,, ,, .	*Atrato* .	18—7	66—40	...	...	...	.....
,, ,, .	*Java* .	24—24	66—59	N.-N.-E.	29·98	...	Light winds and fine.
,, 12th.	*Tibre* .	6—15	79—30	Calm o to 1	30·02	...	Very fine.
,, ,, .	*Peshawar* .	15—39	57—19	N.-E. 3	30·05	...	.....
,, ,, .	*R Rubattino*	17—19	64—25	N.-N.E.	...	...	Fresh winds; sea agitated.
,, ,, .	*Peshwa* .	15—12	73—31	S. 5	30·00	...	Fresh breeze and clear; sea confused.
,, ,, .	*Trossachs* .	16—53	73—38	Variab'e	30·04	...	Clear weather, with light breeze.
,, ,, .	*Atrato* .	18—38	68—27	? 5	29·90	...	Squally, with incessant rain.
,, ,, .	*Clan Sinclair.*	14—54	53—32	N.-E.	30·10	...	.....
,, ,, .	*Golden Horn.*	15—31	73—25	S.-E.	30·03	...	Light winds; fine clear weather.
,, ,, .	*Mecca* .	14—36	54—47	N.	30·10	...	.....
,, ,, .	*Akbar* .	10—34	75—34	...	30·05	...	Smooth sea.
,, ,, .	*Jumna* .	13—21	48—0	...	30·11	...	.....
,, ,, .	*Sierra Pedrosa.*	17—3	73—26	S.-E.	30·02?	...	Light breeze and fine clear settled weather.

Storm No. 50.

DATE.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	WEATHER REMARKS.
1886.		° ′	° ′				
Nov. 12th.	*Waverley* .	18—1?	69—22	E.	29·97	...	Noon, strong wind and heavy rain; 4 P.M. strong breeze; weather clearer; 8 P.M. moderate wind and fine clear weather; midnight, light wind and fine clear weather.
,, ,, .	*Regius* .	14—56	55—49	N.	...	...	.....
,, ,, .	*Henry Bolchknow* .	19—29	71—8	S.-E.	29·97	...	Decreasing wind; confused sea.
,, ,, .	*Culna* .	17—30	72—59	S.-E.	30·03	...	Light breeze and fine.
,, ,, .	*Java* .	24—45	...	Calm	30·04	...	Calm and fine.
,, ,, .	*Peshawar* .	16—31	60—18	N. 6	29·82	...	Strong breeze and overcast; heavy squalls of wind and rain; high N. E. sea.
,, ,, .	*Henry Bolchknow* .	20—42	68—11	...	29·99	...	.....
,, ,, .	*Regius* .	15—52	59—23	N.	...	...	Fresh breeze, with high cross sea.
,, ,, .	*Jumna* .	14—23	52—24	N.-E. 1 to 2	30·06	...	.....
,, ,, .	*Akbar* .	14—21	73—58	N.-E.	30·06	...	Calm and clear.
,, ,, .	*Khiva* .	15—26	73—35	Variable 1 to 2	30·06	...	Light winds and fine clear weather.
,, ,, .	*Mecca* .	15—22	58—7	N.	30·06	...	Moderate breeze and fine.
,, ,, .	*Clan Sinclair* .	15—44	57—34	N.	30·05	...	Moderate breeze; fine and clear.
,, ,, .	*R Rubattino*	15—58	59—44	N.-N.-W.	...	...	High sea.
,, ,, .	*Victoria* .	13—47	51—10	E.-N.-E.	...	...	Light easterly airs and very fine clear weather.
,, ,, .	*Java* .	25—1	62—48	...	29·99	...	Heavy S.-E. swell.
,, ,, .	*Pemba* .	24—30	61—8	N.-E.	30·03	...	Moderate breeze and fine.
,, ,, .	*Peshwa* .	12—26	74—48	S. 4?	30·03	...	Light variable winds.
,, ,, .	*Atrato* .	18—59	72—11	Calm	...	...	.....
,, ,, .	*Sierra Pedrosa* .	18—13	72—59	E.	30·05	...	Light variable airs, with fine weather, hazy over land.
,, ,, .	*Golden Horn* .	17—1	72—46	E.-S.-E.	30·03	...	Light winds and fine clear weather throughout the day.
,, 14th .	*Clan Sinclair* .	15—35	60—55	S. S.-W.	29·97	...	Fresh breeze and cloudy, with heavy confused sea.
,, ,, .	*Mecca* .	15—47	61—27	S.	29·98?	...	Moderate breeze; heavy N.-N.-W. swell.
,, ,, .	*Peshawar* .	18—4	63—41	S.-E. 6	29·92	...	Strong breeze and fine, with passing clouds.
,, ,, .	*Jumna* .	15—12	56—59	N.-W. 2	29·96	...	.....
,, ,, .	*Victoria* .	14—55	55—20	N.-W. 3	29·95	...	Heavy N.-E. swell.
,, ,, .	*Regius* .	16—26	62—57	S.	...	...	.....
,, ,, .	*Mobile* .	25—20	57—50	E.-S.-E.	...	...	Light winds and fine.
,, ,, .	*Java* .	25—5	60—15	Calm	30·01	...	Calm and fine.
,, ,, .	*Pemba* .	25—1	63—25	N.	30·04	...	Heavy swell, light breeze, and clear.
,, ,, .	*H. Bolchknow* .	22—0	65—6	S.-E.	30·00	...	Light breeze and fine.

Storm No. 50.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1886.		° ′	° ′				
Nov. 14th.	*Khiva*	11—50	75—9	N.-W. by N. 2 to 3	30·08	...	Light winds and fine clear weather.
,, ,,	*Golden Horn*	17—43	72—37	S.	30·08	...	Light winds; fine clear weather all day.
,, 15th	*Regius*	17—26	66—42	S.	...	...	Light airs and calm.
,, ,,	*Mobile*	24—50	61—20	E.	29·96	...	1 P.M. passing squalls with rain, thunder, and lightning.
,, ,,	*Java*	25—40	57—28	Calm	29·98	...	Light airs, and calm.
,, ,,	*H. Bolchknow*	23—24	61—48	...	29·85	...	Increasing winds and sea, passing heavy rain squalls..
,, ,,	*Clan Sinclair*	16—54	65—4	S.-S.-E.	30·16	...	Fine and clear.
,, ,,	*Jumna*	16—24	61—28	S. 1-2	30·04	...	Moderate swell from north-east.
,, ,,	*Mecca*	16—48	65—9	S.	29·95	...	Light wind and fine.
,, ,,	*Victoria*	16—0	59—18	W. 2	...	...	Fine clear weather; light breeze.
,, ,,	*County of York*	15—2	56—13	Variable	30·03	...	Light winds; fine clear weather.
,, ,,	*Khiva*	8—11	77—0	N.-W. 1 to 2	30·02	...	Light winds and fine.
,, ,,	*Pemba*	Arrived at Karachi		...	30·02	...	Light breeze and fine.
,, 16th	*Comilla*	Karachi		S.-W.	29·84	...	Moderate gale and squally.
,, ,,	*Mobile*	23—30	62—26	N.-W.	29·77	...	Moderate breeze and fine weather.
,, ,,	*H. Bolchknow*	23—46	59—48	W.-N.-W.	29·95	...	Moderate breeze with fine weather. Sea moderate.
,, ,,	*Arabia*	27—0	52—19	N.-N.-W.	30·11	...	Moderate gale. High sea.
,, ,,	*Jumna*	17—33	66—5	Variable 1	30·07	...	.....
,, ,,	*Victoria*	17—7	63—44	E.	30·00	...	.....
,, ,,	*County of York*	15—50	59—24	Variable	30·03	...	Light variable airs and clear weather; N.-E. swell. Wind increased slightly in force during the evening.
,, 17th	*Jumna*	18—20	70—31	N.-E. 1to2	30·01	...	Light winds from north-east during day. Sea smooth.
,, ,,	*Victoria*	18—1	67—58	N.-E. 2	30·02	...	Light north-east breezes with fine clear weather during day.
,, ,,	*County of York.*	16—26	62—56	N.-E.	30·03	...	Light winds and clear. Sea smooth.
,, ,,	*Mobile*	22—9	65—58	E.-N.-E.	...	...	Light breeze and very fine.

November 10th.

Centre crossed west coast November 11th.

The storm crossed the Western Ghâts near Belgaum and the coast near Goa in Lat. 15° 30′N late on the afternoon of the 10th. On the 11th the probable position of the centre was about Lat. 16°N and Long. 69° 30′E. Two ships, *viz.* the *Waverley* and *Atrato*, were to the north-westward of the storm, and experienced fine weather in the morning and squally, showery weather in the evening. They were both advancing eastward to the neighbourhood of the storm. The *R. Rubattino* was to the northward of the storm, and had fine weather

and a smooth sea. The storm was consequently small—not more than 120 to 150 miles in diameter, and comparatively feeble. On the 12th the storm was increasing in intensity and extent, but the logs of vessels, though more numerous than on the previous day, still do not allow of the position of the centre being determined with certainty. It was probably in Lat. 16° 30N′ and Long. 67°E, having advanced 170 miles at an average rate of 7 miles per hour. The *Atrato* and *Waverley* were now to the north-eastward of the centre, and both had strong winds and heavy rain during the forenoon, and fine weather in the afternoon. The *R. Rubattino* was to the westward of the cyclone, and experienced fresh north-north-east winds, but fair weather. The position of the storm on the 13th can be more accurately determined, the *Peshawar* having passed through the centre in the afternoon and evening of that day. The centre at noon was probably about Lat. 17°N. and Long. 64° 30′E. On the 14th the position of the centre at noon can again only be approximately fixed, but was probably about Lat. 18° 30′N and Long. 60° 30′E. The storm had hence recurved to north. In the immediate neighbourhood of the storm the weather was cloudy and squally, but in other parts of the Arabian Sea was fine, the change to north in the direction of motion of the storm having occasioned a rapid improvement in the weather. At noon on the 15th the centre of the storm was probably in about Lat. 22° 30′N and Long. 61° 30′E. At 5 P.M. the centre passed to the east of the *Henry Bolchknow* at a distance of about 20 miles, and was hence at that time in Lat. 23° 30′N and Long. 62°E., and at 9 P.M. it passed at about the same distance to the east of the *Mobile*, which was in Lat. 24° 25′N. and Long. 61° 55′E. The storm was hence travelling at a rate of about 15 miles per hour, and its diameter was about 130 miles.

Storm No. 50. November 12th.

November 13th.

November 14th.

November 15th.

The storm crossed the Mekran coast during the night of the 15th, and subsequently quickly broke up. The following table gives the position of the centre of the storm at the hours specified, and its probable amount and rate of motion during the intervals elapsed since the hour of the previous position :—

Position of centre, and rate of motion on each day.

Day.	Hour.	Probable position of Centre.		Direction of motion.	Distance passed over.	Rate of motion in miles per hour.
		Latitude N.	Longitude E.			
1886.		° ′	° ′		Miles.	Miles.
Nov. 10th	10 A.M.	15—30	75—30	...	400	18
„ 11th	Noon	16— 0	69—30	W. by N.	430	16½
„ 12th	Do.	16—30	67— 0	W. by N.	170	7
„ 13th	Do.	17— 0	64—30	W. by N.	170	7
	10-30 P.M.	17—15	62—45	...	120	12
„ 14th	Noon	18—30	60—30	W. by N.	180	12
„ 15th	Do.	22—30	61—30	N. by E.	360	12⅓
	5 P.M.	23—30	62— 0	...	70	14
	9 P.M.	24—30	62—15	...	70	17

Storm No. 51. June 1887 Pl. L. *Reference*—Indian Meteorological Memoirs, Vol. V.

Storm No. 51.—The storm was formed off the west coast of India early in June 1887. Full details of the cyclone are given in Mr. F. Chambers' Memoir in Vol. V of the Indian Meteorological Memoirs, and it is from this account that the following *résumé* has been prepared. The following are the data giving the information on which the positions of the centre have been determined:—

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1887.		° ′	° ′				
June 2nd	*Britannia* .	7—22	77—14	S.-W. 5	29·87	75	.....
,, 3rd	*Britannia* .	7—37	74—1	W.-N.-W. 2	29·92	77	Fair.
,, ,, .	*Akbar* . .	13—24	49—47	S.-W. 2to3	29·77	...	.....
,, 4th	*Britannia* .	7—6	70—31	W.-S.-W. 3	29·93	78	Fair.
,, ,, .	*Colaba* .	8—56	76—0	W.-N.-W. 4	29·93	78	Moderate breeze, but frequent squalls.
,, ,, .	*Akbar* .	14—35	54—3	S.-S.-W. 4	29·77	...	.....
,, ,, .	*Jumna* .	8—3	74—51	W.-S.-W. 5	29·93	77	.....
,, ,, .	*Navarino* ..	12—17	48—40	Calm	29·79	...	Fine.
,, ,, .	*Manora* .	10—0	59—11	W.-S.-W. 6	29·80	83	Hard squalls, heavy rain.
,, ,, .	*Clan Matheson*	13—9	43—10	S. 4	29·75	94	Very sultry.
,, 5th.	*Britannia* .	6—58	66—57	W.-S.-W. 2	29·85	78	Cloudy, rain squalls.
,, ,, .	*Draco* . .	16—26	61—28	W.-S.-W. 6	29·74	...	.....
,, ,, .	*Pemba* .	At Karachi		S.-W. 5	29·56	89	.....
,, ,, .	*Akbar* .	15—40	58—24	S.-W. 5	29·75	...	.....
,, ,, .	*Clan Forbes* .	14—1	50—30	S.-W. 3	29·73	90	.....
,, ,, .	*Colaba* .	11—26	74—54	W.-S.-W. 4	29·86	81	Strong breezes, with heavy squalls.
,, ,, .	*Cuba* . .	24—33	66—55	S.-W. 4	29·62	87	.....
,, ,, .	*Orion* . .	15—53	62—6	S.-W. 5	29·66	85	.....
,, ,, .	*Hydaspes* .	7—17	76—59	S.-W. 4	29·92	82	.....
,, ,, .	*Girava* .	13—32	51—7	Calm	29·80	84	P.M. strong squall, heavy rain.
,, ,, .	*Rockcliff* .	13—34	48—22	S.-W. 2	...	...	.....
,, ,, .	*Rothsay* .	12—44	45—24	S. 5	29·72	97	.....
,, ,, .	*Oswald* .	13—34	50—48	E.-S.-E. 3	29·77	90	Midnight heavy swell.
,, ,, .	*Panama* .	15—41	61—1	S.-W. 6	...	...	.....
,, ,, .	*Clan Graham*	18—51	72—49	S.-W. 4	29·60	...	.....
,, ,, .	*Jumna* .	8—16	70—26	W.-S.-W. 3	29·88	76	.....
,, ,, .	*Navarino* .	12—34	52—44	W.-S.-W. 5	29·75	...	.....
,, ,, .	*Manora* .	12—57	55—24	S.-W. 6	29·71	83	Strong monsoon; high sea.
,, ,, .	*Kerbela* .	20—25	70—44	W. 3	29·67	87	Moderate breeze, fair.
,, ,, .	*Clan Matheson.*	12—28	46—54	S.-E. 2 to 3	29·74	90	Fine.
,, 6th .	*Britannia* .	6—44	63—55	S.-W. 3	29·86	80	P.M. fresh wind, and squally.
,, ,, .	*Draco* .	17—12	64—53	W. 4	29·72	...	A.M. westerly swell; P.M. moderate W.-N.-W. breeze.
,, ,, .	*Pemba* .	21—42	69—20	W.-S.-W. 4	29·57	86	10 P.M. 29.49, wind suddenly strong from S.-S.-W.
,, ,, .	*Akbar* . .	16—34	62—47	W. 4	29·76	...	.....
,, ,, .	*Clan Forbes* .	15—1	54—36	S.-S.-W. 6	29·60	88	Strong wind all day, heavy S.-W. swell.
,, ,, .	*Darien* .	12—55	46—0	Calm	29·69	90	.....
,, ,, .	*Colaba* .	13—50	73—55	W.-S.-W. 5	29·79	83	Moderate to strong breeze, heavy squalls and swell.
,, ,, .	*Cuba* . .	21—26	68—40	S.-W. 4	29·57	87	.....
,, ,, .	*Orion* . .	16—51	66—22	W. 2	29·61	92	.....
,, ,, .	*Victoria* .	18—27	68—52	W.-N.-W. 4	...	...	.....
,, ,, .	*Hydaspes* .	8—16	72—47	W. 4	29·83	82	.....

Storm No. 51.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1887.		° ′	° ′				
June 6th .	*Girava* .	14—25	55—19	S. 6	29·80	84	P.M. strong squall, rain, heavy S.-W. swell.
,, ,, .	*Rockcliff* .	14—30	51—45	S. 2 to 3	...	...	Heavy southerly sea.
,, ,, .	*Rothsay*	12—30	49—20	S.-W. 6	29·87	797	4 A. M. fresh wind from S.; noon, wind rising.
,, ,, .	*Lorna Doone*	12—59	63—17	W.-S.-W. 9	29·68	...	Heavy sea.
,, ,, .	*Oswald* .	14—26	54—37	S.-W. 6	29·68	87	Strong wind and heavy sea.
,, ,, .	*Panama* .	16—34	64—37	W.-S.-W. 6	...	...	.....
,, ,, .	*Clan Graham*	18—38	69—18	N.-W. 4	29·64	90	Heavy S.-W. swell, unsteady wind.
,, ,, .	*Jumna* .	8—41	66—25	W.-S.-W. 6	29·82	75	Wind and sea increasing.
,, ,, .	*Navarino* .	12—41	56—59	S.-W. 7	29·75	...	Very hard squalls, high sea.
,, ,, .	*Manora* .	13—19	50—51	S.-S.-W. 4	29·63	88	Fresh to moderate breeze, fine.
,, ,, .	*Kerbela* .	22—38	67—58	W.-4	29·59	87	Moderate to fresh breeze.
,, ,, .	*Clan Matheson.*	12—55	51—13	Calm	29·70	85	A.M. fine; P.M. high swell.
,, 7th .	*Britannia* .	6—54	61—10	S.-W. 5	29·79	78	Fresh to strong breeze, heavy head sea.
,, ,, .	*Draco* .	18—1	68—15	W.-N.-W. 5	29·61	...	Squally, rainy, heavy thunder and lightning.
,, ,, .	*Albany* .	13—32	49—6	S.-W. 2 to 3	...	...	.....
,, ,, .	*Pemba* .	Off Bombay		S.-E. 4	29·50	83	Sharp lightning all morning.
,, ,, .	*Akbar* .	17—39	67—7	W. 5 to 6	29·62	...	P.M. showery, squally.
,, ,, .	*Clan Forbes* .	15—42	58—33	S.-W. 6	29·62	90	Strong wind all day, heavy S.-W. swell.
,, ,, .	*Darien.* .	13—9	50—10	S.-W. 3	29·59	88	.....
,, ,, .	*Colaba* .	16—6	73—1	S.-S.-W. 5	29·53	79	Moderate breezes, frequent squalls, rain.
,, ,, .	*Cuba* . .	19—32	71—46	N.-E. 6	29·54	83	.....
,, ,, .	*Orion* . .	18—2	70—19	W. 4	29·49	...	Heavy gusts of wind; 4 P.M., 29·44, N.-W.; 6 P.M., 29·40, N. 7; midnight, E.-S.-E. 6, 29·45.
,, ,, .	*H. Bolchknow*	24—33	60—54	Calm	29·51	90	E. to S.-E. wind, fine.
,, ,, .	*Victoria* .	17—53	65—26	W. 4	...	...	P.M. fresh S.-W. breeze, heavy sea.
,, ,, .	*Hydaspes* .	9—11	69—11	S.-W. 5	29·68	80	Strong monsoon, squally.
,, ,, .	*Sumatra* .	18—17	70—31	N.-W. 5 to 6	29·545	81	Heavy squalls, threatening.
,, ,, .	*Girava.* .	15—31	59—49	S.-S.-W. 10	29·70	84	S.-S.-W. gale all day.
,, ,, .	*Rockcliff* .	15—21	55—30	S.-S.-W. 6	...	...	Strong breeze, heavy sea.
,, ,, .	*Rothsay* .	12—52	50—37	S.-W. 4	29·62	100	A.M. swell from S.-S.-W.; P.M. fresh S.-S.-E. wind.
,, ,, .	*Lorna Doone*	15—54	63—55	W.-N.-W. 9	29·66	...	Heavy sea.
,, ,, .	*Oswald* .	15—21	58—21	S.-W. 6	29·64	86	Strong wind and heavy sea.
,, ,, .	*Panama* .	17—20	67—59	W.-N.-W. 6	...	...	1 P.M. strong W.-N.-W. gale, heavy squalls.
,, ,,	*Clan Graham*	18—28	66—1	W.-N.-W. 5	29·62	90	Moderate to fresh head wind, heavy sea from W.-S.-W.
,, ,, .	*Satara* .	21—16	69—21	W.-N.-W. 4	29·52	87	.....
,, ,, .	*Jumna* .	8—39	62—59	W.-S.-W. 7	29·76	80	P.M. fresh gale, strong squalls; 4 P.M. S.-W. 9.
,, ,, .	*Navarino* .	11—56	61—21	S.-W. 5	29·70	...	Cloudy, squally.
,, 8th.	*Manora* .	12—29	48—9	W.-S.-W. 5	29·65	90	Fresh breezes.

Storm No. 51.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1887.		° ′	° ′				
June 7th .	*Clan Matheson* . .	13—28	55—34	S.-W. 7	29·63	83	High swell, cloudy.
,, ,, .	*Chanda* .	Off Narrakel		S.-W. 3	29·73	...	P.M. light wind, rainy.
,, ,, .	*Assam* .	Off Bombay		S.-S.-E. 5	...	...	Rain, squally, heavy S.-W. sea.
,, 8th .	*Britannia* .	8—3	58—45	S.-W. 6	29·77	75	Strong breeze to moderate gale, high sea.
,, ,, .	*Knight Companion* .	18—10	68—50	S.-S.-E.	...	...	Heavy squalls.
,, ,, .	*Persia* .	12—34	43—40	N. 4	29·67	92	.....
,, ,, .	*Draco* . .	18—34	71—27	S.-S.-W. 6	29·45	...	2 A.M. 28·86, strong S. wind.
,, ,, .	*Albany* .	15—21	53—4	S.-W.-W. 3	...	...	A.M. heavy southerly swell.
,, ,, .	*Akbar* . .	18—34	71—17	S. 7	29·50	...	A.M. heavy squalls, wind and rain; heavy sea.
,, ,, .	*Clan Forbes* .	16—17	62—38	S.-W. 6	29·58	86	P.M. strong wind to moderate gale, W.-S.-W.
,, ,, .	*Darien* .	14—49	54—18	S.-W. 6	29·59	90	.....
,, ,, .	*Orion* . .	Bombay		S.-E. 6	29·54	83	.....
,, ,, .	*H. Bolchknow*	20—40	64—30	E.-S.-E. 3	29·53	85	Light winds, heavy S.-E. swell.
,, ,, .	*Victoria* .	17—15	62—22	W.-S.-W. 5	...	...	P.M. fresh S.-W. breeze, heavy sea.
,, ,, .	*Hydaspes* .	9—25	65—42	S.-W. 6	29·77	83	Strong monsoon; squally.
,, ,, .	*Sumatra* .	17—41	67—41	W. 8	29·31	81	2 A.M. 29·43, squally; 6 P.M. 29·21, W. 9; midnight 29·13, W. 12.
,, ,, .	*Girava* .	16—33	63—49	S.-S.-W. 10	29·60	84	4 P.M. 29·40, S.-S.-W. 10; 9 P.M. 29·20, tempest.
,, ,, .	*Rockcliff* .	16—11	59—8	S.-S.-W. 6	...	...	Strong breeze; heavy sea.
,, ,, .	*Rothsay* .	12—57	52—57	S. 6	29·62	?96	A.M. heavy southerly swell; P.M. strong breeze, squally.
,, ,, .	*Lorna Doone* .	18—29	64—12	W.-N.-W. 9	29·54	...	Heavy sea, barometer falling.
,, ,, .	*Nizam* .	13—12	49—25	S.-S.-W. 5	29·63	91	Heavy swell.
,, ,, .	*Oswald* .	16—16	62—8	W.-S.-W. 5	29·63	87	Midnight wind and sea rising, torrents of rain.
,, ,, .	*Panama* .	18—11	71—51	S.-W. 9	...	...	Strong gale, heavy rain.
,, ,, .	*Clan Graham*	18—15	62—54	W. 5	29·60	90	Moderate to fresh head wind, heavy sea from W.-S.-W.
,, ,, .	*Eden Hall* .	Off Colaba		S.-S.-W. 6	29·43	87	P.M. strong squally wind, rising sea.
,, ,, .	*Germania* .	12—54	43—36	N.-W. 4	...	...	.....
,, ,, .	*Jumna* .	9—28	59—50	S.-W. 8	29·78	...	Fresh to strong gale.
,, ,, .	*Navarino* .	10—44	65—50	S.-W. 5	29·71	...	Cloudy.
,, ,, .	*R. Morrow* .	18—10	71—52	S.-S.-E.	...	...	Hard squalls and rain.
,, ,, .	*Java* . .	24—38	61—0	S.-E. 4	29·49	84	.....
,, ,, .	*Clan Matheson.*	12—52	60—0	S.-W. 7	29·66	85	High sea; P.M. S.-W. 8, squally.
,, ,, .	*Chanda* .	11—49	75—16	S.-W. 4	29·71	80	Light to moderate wind, rainy; P.M. heavy swell.
,, ,, .	*Assam* .	18—13	69—20	S.-S.-E. 6	29·37	...	A.M. moderate gale, heavy sea; P.M. S.-E. to N.-E., strong gale; 1 P.M. S.-E. 7, 29·29; 4 P.M. E.-S.-E. 9, 29·11; 9 P.M. N.-E. to N. 10, 29·02; midnight Lat. 18° 29′ N., Long. 67° 30′, E., E.-S.-E., 28·92, lightning all round.

Storm No. 51.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1887.		° ′	° ′				
June 9th .	*Britannia* .	10—19	56—58	S.-W. 6	29·74	73	A.M. moderate gale; P.M. fresh gale, squally.
,, ,, .	*Knight Companion.*	17—52	67—20	S.-S.-E.	...	...	Heavy squalls.
,, ,, .	*Persia* . .	13—0	47—22	S.-W. 4	29·65	? 99	.....
,, ,, .	*Assam* . .	18—57	66—16	S. 5	29·58	82	0-15 A.M. sudden shift to S.-E.; 0-30 A.M., hurricane again; 2 A.M., squally, 29·26; 3-30 A.M. 29·35, decreasing wind; P.M., S-W. squalls of hurricane force.
,, ,, .	*Clan Forbes* .	17—2	65—5	S.-W. 2	29·13	78	1 A.M. S.-S.-W. fresh gale; 6 A.M. terrific W.-S.-W. gale; 8 A.M hurricane; P.M. gale continues; 8 P.M., 29·14.
,, ,, .	*Darien* . .	16—3	58—30	S.-W. 6 to 7	29·59	90	11 P.M. bar. suddenly fell, wind blowing terrific force.
,, ,, .	*Ætolia* .	18—27	70—0	S.-S.-E 4	29·62	...	P.M. strong breeze, squally, heavy sea.
,, ,, .	*Victoria* .	16—41	59—29	W.-S.-W. 8	...	...	.....
,, ,, .	*Hydaspes* .	9—49	62—33	W.-S.-W. 7	29·75	82	Strong monsoon, squally.
,, ,, .	*Sumatra* .	18—1	66—17	S. 7.	29·39	...	1 A.M. 29·11, W.; 8 A.M. moderate gale; P.M. strong winds.
,, ,, .	*Girava* . .	17—50	68—22	S.-S.-W. 8	29·40	81	1 A.M., 29·00; 4 A.M. 29·30; 4 P.M. 29·60.
,, ,, .	*Rockcliff* .	17—0	62—49	S.-W. 7	...	...	2 P.M. N.-W. 9; 8 P.M. S.-W. 12.
,, ,, .	*Rothsay* .	13—2	55—30	S.-S.-W. 11	29·67	?97	2-30 P.M. terrific gale, tremendous sea all day.
,, ,, .	*Lorna Doone*	19—48	64—33	N.-E. 12	29·42	...	1 A.M. N.-W. 9; 2 A.M. gale increasing, wind drawing to N.; 4 A.M. wind N.-E., 12; P.M., fearful weather; midnight, barometer suddenly fell to 28·86, hurricane.
,, ,, .	*Nizam* .	14—29	54—22	S.-S.-W. 7	29·61	80	Moderate gale, heavy sea.
,, ,, .	*Oswald* .	16—48	64—49	S.-W. 12	29·20	81	A.M. moderate, W.-S.-W. gale; 2 A.M. increasing S.-W. gale; 5 A.M. furious gale; 10 A.M. hurricane; 4 P.M. bar. rising, wind moderating; 8 P.M. 29·40.
,, ,, .	*Clan Graham*	17—32	60—2	W. 6	29·58	89	A.M. fresh wind; P.M. strong gale, dangerous sea.
,, ,, .	*Tarpeia* .	12—29	46—16	S.-W. 5	...	...	.....
,, ,, .	*Eden Hall* .	18—25	70—21	S. 3	29·52	86	Wind drawing to W., heavy sea; P.M. squalls of rain.
,, ,, .	*Germania* .	11—57	46—57	W. 2 to 3	...	...	.....
,, ,, .	*Jumna* .	11—24	57—0	S.-W. 9	29·65	78	8 A.M. S.-W. 10; 8 P.M. to midnight S.-W. 11.
,, ,, .	*Nurjahan* .	8—29	76—48	W.-N.-W. 4	29·87	84	Moderate breeze and squally.

Storm No. 51.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1887.		° ′	° ′				
June 10th.	*Navarino* .	9—43	70—13	S.-S.-W. 4	29·77	...	Cloudy.
,, ,, .	*R. Morrow* .	17—35	71—3	S.-S.-E. 7	...	...	P. M. hard squalls and rain.
,, ,, .	*Java* . .	25—0	63—24	E. 4	29·53	87	Dull weather.
,, ,, .	*Clan Matheson*	11—40	64—29	W.-S.-W. 8	29·67	85	Squally and high sea.
,, ,, .	*Chanda* .	Off Karwar		S.-W.-W. 6	29·73	82	A.M. strong squally breeze, rain; P.M. heavy rain, high swell.
,, ,, .	*Britannia* .	12—25	54—55	S.-W. 9	29·67	73	A.M. fresh gale, heavy sea; 8 A.M. hard gale; P.M. heavy S.-W. gale.
,, ,, .	*Knight Companion.*	17—54	66—5	Variable	...	...	Heavy squalls.
,, ,, .	*Persia* .	13—40	51—56	S.-S.-W. 4	29·67	87	P.M. strong breeze, heavy sea.
,, ,, .	*Albany* .	19—49	60—35	N.-W. 5	29·20	84	Wind veering to northward, northerly sea; 8 P.M. 29·10.
,, ,, .	*Assam* .	17—25	64—32	S.-S.-W. 9	29·50	88	Strong S.-S.-W. gale all day.
,, ,, .	*Clan Forbes* .	16—36	66—0	S.-W. 9	29·53	88	Decreasing strong gale; midnight, moderate gale.
,, ,, .	*Darien* .	17—16	62—40	S.-W. 11	29·39	90	4 A.M. 29·29, heavy-S.-W. hurricane, lightning; 8 P.M. S.-S.-W. 6, 29·59.
,, ,, .	*Ætolia* .	16—23	68—44	W.-S. 6	29·70	...	Strong breeze, squally.
,, ,, .	*Victoria* .	16—5	57—29	W.-S.-W. 8	...	...	Fresh gale, heavy sea.
,, ,, .	*Hydaspes* .	11—8	59—41	S.-S.-W. 7	29·68	81	P.M. fresh to strong S.-S.-W. gale, furious squalls.
,, ,, .	*Sumatra* .	17—52	64—49	S.-S.-W. 6	29·45	...	Strong wind, very heavy sea.
,, ,, .	*Girava* .	18—26	72—28	S.-S.-E. 4	29·70	81	Weather moderate.
,, ,, .	*Rockcliff* .	17—34	66—38	S.-W. 6	...	...	1 A.M. storm continues; 4 A.M. moderating.
,, ,, .	*Rothsay* .	14—39	58—13	S.-S.-W. 10	29·52	? 97	A.M. fresh gale; P.M. heavy gale, terrific squalls.
,, ,, .	*Lorna Doon* .	19—52	63—53	S.-S.-E. 8	29·32	...	4 A.M. southerly hurricane; 5-30 A.M. bar. rose; P.M. moderating.
,, ,, .	*Nizam* .	16—6	59—19	S.-W. 9	29·24	81	A.M. wind and sea rising, fast falling bar., vivid lightning; P.M. hard gale, furious squalls.
,, ,, .	*Oswald* .	16—32	67—19	W.-S.-W. 8	29·66	83	P.M. wind and sea moderating.
,, ,, .	*Clan Graham*	16—58	58—20	W. 9	29·51	87	Strong unsteady gale, tremendous sea.
,, ,, .	*Satara* .	24—48	63—56	S.-E. 4	29·53	89	Moderate wind, heavy swell.
,, ,, .	*Tarpeia* .	12—30	49—42	S.-W. 5	...	...	Noon, high sea.
,, ,, .	*Eden Hall* .	17—59	68—9	W.-S.-W. 5	29·53	84	Fresh to strong wind, squally, showery.
,, ,, .	*Germania* .	13—14	50—35	S.-W. 4	...	...	P.M. fresh wind, heavy cross sea.
,, ,, .	*Jumna* .	13—3	54—13	S.-W. 6	29·54	75	4 A.M. to 7 A.M. terrific gale; P.M. moderating.
,, ,, .	*Pachumba* .	22—54	68—0	S.-S.-E. 5	29·61	86	Fresh breeze and cloudy.
,, ,, .	*Navarino* .	8—27	73—57	S.-S.-W. 3	29·83	...	Heavy rain.
,, ,, .	*R. Morrow*	17—26	71—0	S. 6	...	...	Ditto.
,, ,, .	*Merton Hall*	12—22	43—59	Variable	29·64	...	.....

Storm No. 51.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1887.		° ′	° ′				
June 10th.	*Java*	24—45	66—46	E. 4	29·60	86	High swell.
,, ,,	*Europa*	19—1	70—25	S. 5	...	...	High sea.
,, ,,	*Clan Matheson*	10—28	68—7	S.-W. 7	29·80	83	Moderating.
,, ,,	*Chanda*	17—29	72—50	S.-W.-W.-S.-W. 4.	29·70	80	A.M. heavy squalls, high sea; P.M. moderate breeze, heavy swell.
,, ,,	*Canara*	17—21	72—3	S.-W. 6	29·76	82	Strong wind, heavy rain, squalls.
,, 11th	*Britannia*	Off Socotra		S.-W. 9 to 10	29·65	86	A.M. hard gale; P.M. strong gale.
,, ,,	*Knight Companion.*	17—59	65—39	Variable	...	...	Heavy squalls, heavy cross sea.
,, ,,	*Winenhoe*	13—18	50—15	W.-S.-W. 7	29·55	...	P.M. heavy sea from southward.
,, ,,	*Persia*	15—10	56—0	W.-S.-W. 7	29·45	86	Strong breeze, tremendous sea.
,, ,,	*Albany*	19—4	60—25	Calm	28·85	85	6 A.M. N. 9; 10 A.M. S.-W. swell observable at times. Dead calm for 15 minutes at noon, when wind burst out with hurricane fury from S.; 2 P.M. 28·91; P.M. fresh S. breeze.
,, ,,	*Assam*	17—10	62—30	S.-S.-W. 7 to 9	29·49	86	Monsoon gales, heavy sea.
,, ,,	*Clan Forbes.*	17—33	69—38	S.-W. 4	29·63	87	Moderate gale to fresh wind.
,, ,,	*Darien.*	18—40	66—40	S.-S.-W. 6	29·59	87	.....
,, ,,	*Ætolia*	18—20	66—19	W.-S.-W. 6	...	...	A.M. squally; P.M. fair, moderate breeze.
,, ,,	*H. Bolckhknow*	22—47	67—58	S. 5	29·61	83	Moderate to fresh breezes, heavy southerly swell.
,, ,,	*Victoria*	15—50	56—18	W.-S.-W. 8	...	...	A.M. fresh gale, heavy sea; P.M. decreasing.
,, ,,	*Hydaspes*	12—31	57—1	S.-S.-W. 9	29·62	80	Strong gale.
,, ,,	*Sumatra*	18—19	63—29	S.-S.-W. 6	29·61	...	Strong wind, very heavy sea.
,, ,,	*Rockcliff*	18—16	69 - 46	S. 4	...	...	P. M. sea moderating.
,, ,,	*Rothsay*	16—6	61—52	S.-S.-W. 8	29·57	? 95	A.M. terrific squalls, tremendous sea; P. M. weather moderating.
,, ,,	*Lorna Doone*	19—5(	64—2	...	29·56	...	.....
,, ,,	*Nizam*	16-6(?)	59—2	S.-W. 10	29·41	80	Ship hove to, whole gale, tremendous sea.
,, ,,	*Oswald*	17—53	70—46	W.-S.-W. 4	29·77	84	.....
,, ,,	*Clan Graham*	16—55	57—40	Variable	?	?	8 A.M. terrific gale, tremendous sea; 9 A.M. ship in centre of cyclone, rapid shifts of wind all directions, torrents of rain; 3 P.M. strong gale from north-west, then west-south-west.
,, ,,	*Satara*	24—52	59—49	W. 2 to 3	29·50	88	Southerly swell.
,, ,,	*Tarpeia*	13—34	53 5	S.-W. 8	...	...	Fresh gale and very high sea.
,, ,,	*Eden Hall*	17—34	66—31	S.-W. 6	29·57	85	Strong squally winds, high sea.
,, ,,	*Germania*	14—27	54—5	W.-S.-W. 8	...	...	4 A.M. strong gale, high sea all day.
,, ,,	*Jumna*	13—39	52—34	S.-S.-W. 7	29·58	? 74	A.M. strong gale; P.M. light winds.

Storm No. 51.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
		° ′	° ′				
1887.							
June 12th	*Purulia* .	27—18	52—2	S. 2 to 3	29·55	91	Fine.
,, ,, .	*Pachumba* .	20—21	70—30	S.-W. 5	29·65	82	Drizzling rain, cloudy.
,, ,, .	*Navarino* .	7—35	77—49	W. 2	29·82	...	Fine.
,, ,, .	*R. Morrow* .	16—45	72—0	W.-S.W. 7	...	...	Moderate gale, squalls, and rain.
,, ,, .	*Merton Hall*	13—12	48—36	S.-W. 5	29·61	87	A.M. moderate south-west swell; P.M. heavy south-westerly swell, increasing west-south-west breeze.
,, ,, .	*Europa* .	18—52	68—8	S.-W. 5	...	...	High sea, squally.
,, ,, .	*Clan Matheson*	8—37	72—26	S.-W. 4	29·76	82	Fine.
,, ,, .	*Canara* .	Mormugao		Variable	29·77	82	Heavy swell.
,, ,, .	*Bedouin* .	12—20	44—45	Calms	29·73	96	Light unsteady wind.
,, ,, .	*Comilla* .	20—37	69—49	S.-W. 4	29·61	84	Heavy sea, rain squalls.
,, ,, .	*Britannia* .	12—53	53—10	S.-W. 8	29·60	? 70	4 A.M. terrific gale; P.M. wind and sea moderating.
,, ,, .	*Knight Companion.*	16—47	66—10	W.-S.-W. 4	...	...	.....
,, ,, .	*Winenhoe* .	14—30	53—56	S.-W. 6	29·50	...	A.M. cloudy, heavy squalls, heavy sea; P.M. less wind.
,, ,, .	*Oriental* .	3—33	50—8	S. 4	29·86	...	.....
,, ,, .	*Clan Graham*	16—40	58—21	W.-S.-W. 10	29·51	86	4 A.M. 29·38, fierce gale, dangerous sea; noon, fierce gale, dangerous sea.
,, ,, .	*Persia* . .	15—43	60—7	W.-S.-W. 5	29·60	86	Strong breeze, tremendous sea.
,, ,, .	*Albany* .	19—55	62—6	S.-S.-W. 7	29·52	83	.....
,, ,, .	*Assam* . .	16—27	59—50	S.-W. 9	29·49	85	Monsoon gales, heavy sea.
,, ,, .	*Ætolia* .	17—47	64—16	S.-W. 5	29·66	...	Moderate to strong breeze, squally, rainy.
,, ,, .	*H. Bolchknow*	21—7	69—16	S.-W. 5	29·67	83	Moderate to fresh breezes, heavy southerly swell.
,, ,, .	*Victoria* .	15—9	54—21	S.-W. 6	...	...	.....
,, ,, .	*Hydaspes* .	12—56	53—58	S.-S.-W. 7	29·61	81	Moderating.
,, ,, .	*Sumatra* .	17—28	61—9	S.-S.-W. 6	29·46(?)	...	.....
,, ,, .	*Rothsay* .	17—7	65—11	S.-S.-W. 5	29·67	? 91	Steady breeze, heavy swell.
,, ,, .	*Nizam* .	15—8	58—34	S.-W. 10	29·56	81	A.M. hard gale, furious squalls; P.M. same weather.
,, ,, .	*Satara* .	26—25	56—46	S.-S.-E. 4	29·47	? 97	Light breeze.
,, ,, .	*Tarpeia* .	14—50	56—26	S.-W. 8	...	...	P.M. hard gale, mountainous sea.
,, ,, .	*Eden Hall* .	16—50	65—6	W.-S.-W. 5	29·60	86	Strong squally winds, high sea.
,, ,, .	*Germania* .	15—20	57—59	S.-W. 9	...	...	4 A.M. strong gale, high sea all day.
,, ,, .	*Jumna* .	12—48	48—54	W. 4	29·52	86	Fresh wind, fair.
,, ,, .	*Scindia* .	17—0	72—13	W.-S.-W. 5	29·71	83	A.M. squally, with rain; P.M. rain.
,, ,, .	*Nurjahan* .	12—9	74—55	W.-N.-W. 6	29·82	80	Squally, with rain, heavy northerly swell.
,, ,, .	*R. Morrow* .	15—0	72—22	W.-S.-W. 7	...	...	Moderate gale, squalls and rain.
,, ,, .	*Merton Hall.*	13—57	52—49	W.-S.-W. 6	29·61	85	Strong breeze, high sea; P.M. dull, high sea.
,, ,, .	*Kerbela* .	22—52	64—16	S.-W. 4	29·47	87	.....
,, ,, .	*Europa* .	18—45	65—40	S.-W. 5	...	...	High sea, squally.
,, ,, .	*Dunbar* .	18—12	70—30	W.-S.-W. 6	29·64	...	Weather stormy.
,, ,, .	*Comilla* .	23—37	67—19	S.-W. 6	29·58	84	Squally.

Storm No. 51.

DATE.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	WEATHER REMARKS.
		° ′	° ′				
1887.							
June 12th.	*Clan Matheson.*	7—37	76—33	W.S.-W.-3	29·85	85	Fine.
,, ,, .	*Camnara* .	Karwar		N.-W. 4	29·81	80	Thick, rainy weather.
,, ,, .	*Bedouin* .	13—12	48—40	S.-W. 5	29·74	? 97	Fresh breezes, heavy squalls.
,, ,, .	*Athabasca* .	12—38	45—27	S.-W. 2 to 3	...	...	.....
,, 13th	*Britannia* .	12—42	49—59	W. 4	29·67	82	Fresh breezes.
,, ,, .	*Winenhoe* .	4—56	57—45	N. 6	29·49	...	A.M. south-west strong wind; P.M. squally, with rain.
,, ,, .	*Swordsman* .	3—40	47—32	S.-S.-W. 3	29·97	83	P.M. strong squally breezes.
,, ,, .	*Oriental* . .	6—58	49—36	S. 4	29·86	...	.....
,, ,, .	*Clan Graham*	15—56	58—21	W.-S.-W. 9	?	...	Strong gale continues.
,, ,, .	*Persia* . .	16—59	64—10	W.-S.-W. 5	29·65	83	Strong breeze, tremendous sea.
,, ,, .	*Albany* .	23—10	65—13	S.-W. 4	...	...	.....
,, ,, .	*Assam* . .	15—39	57—59	S.-W. 8	29·53	92	Monsoon gales, heavy sea.
,, ,, .	*Ætolia* .	17—29	62—26	W.-S.-W. 6	29·70	...	.....
,, ,, .	*H. Bolchknow*	18—43	71—50	S.-W. 4	29·72	83	Fair.
,, ,, .	*Victoria* .	14—5	53—7	S.-S.-W. 7	...	...	.....
,, ,, .	*Hydaspes* .	12—57	49—18	S.-W. 5	29·69	85	Fresh wind.
,, ,, .	*Sumatra*	16—45	58—1	W.-S.-W. 6	29·67	...	.....
,, ,, .	*Rothsay* .	17—55	68—40	S.-S.-W. 6	29·69	? 89	Gloomy, showery.
,, ,, .	*Nizam* .	13—12	60—24	S.-W. 7	29·68	83	Moderate gale, hard squalls.
,, ,, .	*Tarpeia* .	15—52	60—8	S.-W. 8	...	...	Fresh gale, squally, high sea.
,, ,, .	*Eden Hall* .	16—19	63—50	W.-S.-W. 5	29·59	84	Strong squally winds, high sea.
,, ,, .	*Germania* .	16—14	61—43	S.-W. 8	...	...	Noon moderating.
,, ,, .	*Scindia* .	13—44	73—27	W.-S.-W. 4	29·80	80	A.M. heavy westerly swell; P.M. moderate, wind squally.
,, ,, .	*Pandora* .	18—17	70—27	W.-S.-W. 4	29·68	...	.....
,, ,, .	*Nurjahan* .	15—2	73—32	W. 6	29·83	82	Heavy westerly swell.
,, ,, .	*R. Morrow* .	13—20	73—46	W.-N.-W. 7	...	...	Moderate gale, squalls and rain.
,, ,, .	*Merton Hall*	15—11	57—4	S.-W. 7	29·67	82	Dark weather, high sea.
,, ,, .	*Kerbela* .	20—58	61—37	S.-W. 3	29·55	87	Moderate to light breeze, fine.
,, ,, .	*Java* . .	21—37	69—33	S.-W. 5	29·65	84	Fresh breeze, passing squalls; P.M. high sea.
,, ,, .	*Europa* .	18—40	63—23	S.-W. 5	...	...	High sea, squally, heavy rain.
,, ,, .	*Eddystone* .	12—9	48—12	Calm	...	...	.....
,, ,, .	*Dunbar* .	17—50	68—8	W.-S.-W. 11 to 12	29·59	...	Wind hurricane force at times, squally.
,, ,, .	*Canara* .	Mangalore		Calm	29·79	80	P.M. strong, squally W.-N.-W. wind.
,, ,, .	*Bedouin* .	13—50	52—22	N.-E. 4	29·69	86	P.M. strong wind, heavy swell.
,, ,, .	*Athabasca* .	13—7	49—27	S.-W. 6	...	...	Midnight, gale.
,, 14th	*Britannia* .	11—57	46—56	S.-W. 5	29·69	83	Strong breeze.
,, ,, .	*Winenhoe* .	15—37	61—33	S.-W. 5	29·48	...	Strong wind and rain squalls.
,, ,, .	*Swordsman* .	7—11	49—47	S.-W. 4	29·91	80	.....
,, ,, .	*Oriental* .	11—8	51—46	S. 7	...	...	Strong monsoon, high sea.
,, ,, .	*Clan Graham*	?	?	W.-S.-W. 9	29·70	...	Strong gale, mountainous sea.
,, ,, .	*Persia* . .	17—55	68—27	W.-S.-W. 5	29·67	85	Fresh wind and squally.
,, ,, .	*Assam* . .	14—18	54—39	S.-W. 7	29·70	88	Strong monsoon.
,, ,, .	*Ætolia* .	17—16	60—41	W.-S.-W. 6	29·70	...	.....
,, ,, .	*Victoria* .	13—30	50—14	S.-W. 5	...	...	.....
,, ,, .	*Hydaspes* .	12—53	45—14	W.-S.-W. 4	29·69	88	Light wind.

Storm No. 51.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1887.		° ′	° ′				
June 14th	*Sumatra*	15—41	55—18	S.-W. 6	29·63	...	.....
,, ,,	*Nizam*	14—44	65—14	W.-S.-W. 7	29·73	81	Moderate gale.
,, ,,	*Tarpeia*	15—48	64—0	S.-W. 8	...	...	Fresh gale.
,, ,,	*Eden Hall*	16—5	62—34	W.-S.-W. 5 to 6.	29·62	82	Strong squally winds, high sea, lightning in north.
,, ,,	*Germania*	16—52	65—48	S.-W. 6	...	...	Fresh to strong winds, passing showers.
,, ,,	*Scindia*	9—15	75—46	W. 4	29·87	80	Moderate breeze, squally.
,, ,,	*Purulia*	25—46	56—58	S.-S.-W. 2 to 3	29·58	89	Light wind and fine.
,, ,,	*Pandora*	17—47	68—20	W. 7	29·64	...	Heavy sea from S.-W.
,, ,,	*Nurjahan*	18—17	72—47	W.-S.-W. 5	29·68	77	.....
,, ,,	*R. Morrow*	10—56	74—49	Variable	...	...	Moderate gale, squalls and rain.
,, ,,	*Merton Hall*	16—23	61—20	S.-W. 7	29·71	84	Dark weather, high sea, heavy rain, squally.
,, ,,	*Kerbela*	18—53	59—11	W.-S.-W. 3	29·61	88	Moderate monsoon, heavy head sea.
,, ,,	*Europa*	18—23	61—3	S.-W. 6	...	...	High sea, squally, heavy rain.
,, ,,	*Eddystone*	13—20	51—48	E.-S.-E. 5	...	...	A.M. strong swell from S.-E; P.M. sea increasing.
,, ,,	*Dunbar*	17—25	66—32	W.-S.-W. 11	29·64	...	Wind hurricane force at times, rain squalls.
,, ,,	*Canara*	Cannanore		N.-W. 5	29·90	79	Rain.
,, ,,	*Calder*	19—27	71—12	S.-W. 6	29·60	...	Heavy swell, constant rain.
,, ,,	?	16—8	72—44	S.-W. 6	...	...	High sea, heavy rain.
,, ,,	*Bedouin*	14—56	56—1	S.-S.-W. 6	29·69	87	A.M. increasing wind; P.M. strong gale.
,, ,,	*Athabasca*	14—1	52—52	W.-S.-W. 8	...	...	P.M. strong gale, high sea.
,, 15th.	*Winenhoe*	16—36	65—35	W.-S.-W. 6	29·45	...	Strong wind and rain squalls.
,, ,,	*Swordsman*	11—4	53—3	S.-W. 7	29·81	77	.....
,, ,,	*Oriental*	12—19	49—27	Variable	...	...	.....
,, ,,	*Rewa*	12—52	47—38	W.-S.-W. 4	29·70	...	.....
,, ,,	*Clan Graham*	14—30	57—21	W.-S.-W. 9	29·76	...	Gale moderating, but sea still tremendous.
,, ,,	*Assam*	13—37	50—43	W. 5	29·74	90	Moderate monsoon.
,, ,,	*Ætolia*	16—45	58—17	W.-S.-W. 6	29·74	...	.....
,, ,,	*Victoria*	12—40	47—26	W.-S.-W. 5	...	...	.....
,, ,,	*Sumatra*	14—40	53—13	S.-W. 6	29·70	...	.....
,, ,,	*Nizam*	17—16	69—54	S.-W. 8	29·64	79	Moderate gale.
,, ,,	*Tarpeia*	16—37	67—27	S.-W. 8	...	...	Fresh gale, heavy showers and squalls.
,, ,,	*Eden Hall*	15—46	61—13	S.-W. 6	29·62	83	P.M. moderate gale, high head sea.
,, ,,	*Germania*	17—14	69—48	S.-W. 6	...	...	.....
,, ,,	*Scindia*	6—44	79—3	S.-W.	29·92	82	Unsteady breeze.
,, ,,	*Purulia*	25—8	60—1	S.-E. 2 to 3	29·51	89	Light wind, heavy southerly swell.
,, ,,	*Pandora*	18—5	65—54	W. 8	29·54	...	Heavy sea from S.-W., cloudy.
,, ,,	*Merton Hall*	17—21	65—45	S.-W. 7	29·69	82	Moderate gale, heavy rain, high sea.
,, ,,	*Kerbela*	17—1	57—4	S.-W. 5	29·63	85	Fresh to strong monsoon.
,, ,,	*Europa*	17—17	58—51	S.-W. 6	...	...	High sea, squally.
,, ,,	*Eddystone*	14—33	55—25	S.-S.-W. 6	...	...	Strong squally wind, heavy sea.
,, ,,	*Dunbar*	16—53	64—52	W.-S.-W. 9	?	...	Blowing hard.
,, ,,	*Canara*	Narakal		S. 4	29·90	85	Cloudy, dull.
,, ,,	*Calder*	20—22	68—15	S.-W. 6	29·58	...	Squally, heavy S.-W. sea.

Storm No. 51.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1887.		° ′	° ′				
June 16th	?	12—15	73—59	S.-W. 5	...	...	Showery.
,, ,,	*Bedouin*	15—58	59—50	S.-S.-W. 8 to 9.	29·74	87	Gale, heavy sea; midnight moderating.
,, ,,	*Athabasca*	15—9	56—29	S.-W. 9	...	...	Strong gale, very heavy sea.
,, ,,	*Winenhoe*	17—37	69—39	W.-S.-W. 9	29·61	...	A.M. strong gale, rain.
,, ,,	*Swordsman*	13— 0	56—46	S.-W. 9	29·78	83	Stormy gale, heavy sea.
,, ,,	*Rewa*	12—43	51—38	S. 4	29·72	...	.....
,, ,,	*Clan Graham*	14—13	56—0	S.-W. 7	29·79 ?	...	Moderate gale, squally.
,, ,,	*Assam*	13— 0	46—15	W.-S.-W. 3 to 4	29·97	91	Moderate monsoon, fine.
,, ,,	*Ætolia*	15—56	56—58	W.-S.-W. 6	29·75	...	.....
,, ,,	*Tarpeia*	17—46	70—58	S.-W. 8	...	...	.....
,, ,,	*Eden Hall*	15—32	60—9	W.-S.-W. 5	29·65	85	P.M. wind and sea moderating.
,, ,,	*Purulia*	24—50	63—30	W.-S.-W. 4	29·47	85	Fair, heavy southerly swell.
,, ,,	*Pandora*	17—25	64— 1	W.-S.-W. 6	29·66	...	Heavy sea from S.-W., cloudy.
,, ,,	*Merton Hall*	18—19	70—15	W. 7	29·69	81	Moderate gale, heavy rain, high sea.
,, ,,	*Kerbela*	15—26	55—58	S.-W. 6	29·72	86	Fresh monsoon.
,, ,,	*Europa*	16—18	57—11	S.-W. 8	...	...	.....
,, ,,	*Eddystone*	15—52	59— 0	S.-W. 6	...	...	Strong squally wind, heavy sea.
,, ,,	*Dunbar*	16—40	63—42	W.-S.-W. 9	29·64	...	Steady hard gale.
,, ,,	*Canara*	8—10	77— 7	N.-E. 2 to 3	29·89	87	Light wind, fine.
,, ,,	*Calder*	21—58	66—26	W. 6	29·58	82	A.M. heavy S.-W. sea; P.M. fresh gale.
,, ,,	?	9—27	76— 0	Calm	...	...	.....
,, ,,	*Bedouin*	17—22	63—44	S.-W. 6	29·81	87	Strong wind, high sea.
,, ,,	*Athabasca*	16—19	60—28	S.-W. 8-9	...	...	Very heavy sea.
,, 17th	*Swordsman*	14—34	60—31	S.-W. 7	29·76	83	A.M. fresh to strong gale.
,, ,,	*Rewa*	12—52	56— 3	S.-W. 6	29·78	...	Fresh wind; high confused sea.
,, ,,	*Ætolia*	15—11	54—36	W.-S.-W. 5	29·74	...	.....
,, ,,	*Eden Hall*	15— 9	59—18	W.-S.-W. 6	29·66	83	Strong wind, high sea.
,, ,,	*Purulia*	Karachi		W.-S.-W. 4	29·47	85	.....
,, ,,	*Pandora*	17—27	51— 9	W.-S.-W. 7	29·60	...	.....
,, ,,	*Kerbela*	14—36	53—48	S.-W. 7	29·73	86	Fresh monsoon.
,, ,,	*Europa*	15—24	55—34	S.-W. 5	...	...	.....
,, ,,	*Eddystone*	17—22	62—34	S.-W. 6	...	...	Increasing wind and sea.
,, ,,	*Dunbar*	16—45	61—46	W.-S.-W. 9	29·64	...	Steady hard gale.
,, ,,	*Calder*	22—51	63—10	S.-W. 6	29·58	83	Moderating.
,, ,,	?	6—39	78—48	S.-W. 3	...	...	.....
,, ,,	*Bedouin*	17—50	67—30	S.-W. 5	29·75	88	Strong wind, high sea.
,, ,,	*Athabasca*	17—12	64—31	S.-W. 8	...	...	Less wind and sea.
,, 18th	*Swordsman*	16—3	64—21	W.-S.-W. 6	29·75	83	.....
,, ,,	*Rewa*	12—11	60—30	W.-S.-W. 5	29·83	...	Fresh wind, high confused sea.
,, ,,	*Eden Hall*	14—46	58—16	W.-S.-W. 5	29·67	84	Strong wind, high sea.
,, ,,	*Pandora*	17—50	59—28	W.-S.-W. 6	29·60	...	.....
,, ,,	*Kerbela*	13—43	50—48	S. 4	29·70	89	.....
,, ,,	*Eddystone*	18—3	66—14	W.-S.-W. 5	...	...	Heavy swell, wind decreasing.
,, ,,	*Dunbar*	16—54	59—51	S.-W. 7	29·69	...	Strong wind, improving.
,, ,,	*Calder*	24—5	60—56	S.-S.-W. 2 to 3.	29·50	...	Fine, heavy swell.
,, ,,	*Bedouin*	18—12	71—17	S.-W. 6	29·79	94	Moderating.
,, ,,	*Athabasca*	17—58	68—29	W.-S.-W. 7	...	...	Showery.
,, 19th	*Rewa*	11—9	64—51	W.-S.-W. 5	29·86	...	Squalls, with rain.
,, ,,	*Eden Hall*	14—44	56—34	S.-W. 5	29·66	83	Fresh to moderate breeze, fine.

Storm No. 51.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
		° ′	°				
1887.							
19th June	*Pandora* .	15—51	56—55	S.-W. 6	29·62	...	.....
,, ,, .	*Kerbela* .	13—8	47—58	S.-W. 3	29·72	90	Light airs.
,, ,, .	*Dunbar* .	16—32	57—4	S.-W. 6	29·66	...	Weather moderating.
,, ,, .	*Athabasca* .	18—45	71—45	W.-S.-W. 2 to 3.	...	...	.....
,, 20th .	*Rewa* . .	10—6	68—38	W.-N.-W. 4	29·88	...	Fine.
,, ,, .	*Pandora* .	14—52	54—27	S.-W. 4	29·66	...	.....
,, ,, .	*Kerbela* .	12—45	45—21	W. 6	29·72	89	Fresh breeze.
,, ,, .	*Dunbar* .	15—26	54—54	S.-W. 6	29·71	...	.....
,, 21st .	*Rewa* . .	9—0	72—20	W.-N.-W. 4	29·89	...	Fine.
,, ,, .	*Pandora* .	14—31	51—24	S. 6	29·62	...	.....
,, ,, .	*Dunbar* .	14—54	52—52	W.-S.-W. 9	?	..	Gale all day.
,, 22nd .	*Rewa* . .	7—33	76—37	N.-W. 3	29·87	...	Fine.

June 4th.

The chart of the 4th June 1887 gave comparatively little indication of the cyclone. The winds in the west coast districts were from the ordinary monsoon directions, but the force was less than usual, and the lines of equal pressure of 29·7″ and 29·8″ had widened out considerably. An area of relatively low pressure lay off the west coast,

Area of low pressure lying off west coast.

the centre lying off the coast between Ratnagiri and Karwar. Heavy rain had fallen along the coast from Karwar southward. The ships on this day were widely, but very sparingly, distributed throughout the Arabian Sea, and their logs apparently showed that, except in that portion of the sea noticed above, fairly normal wind and weather conditions prevailed. The chart of the 5th exhibits a considerable

June 5th. Barometer fallen 0·1″.

development. The barometer had fallen nearly 0·1″ over the eastern portion of the Arabian Sea, and the winds in the northern parts of the west coast had backed so as almost to complete a cyclonic circulation. Heavy rain had continued on the west coast of India,

Heavy rain.

and rain had also occurred on the western side of the Arabian Sea. The wind had apparently veered somewhat over the central and western districts of the Arabian Sea, but there is hardly anything in the ships' observations which, apart from the light thrown by subsequent experience, would indicate that a severe cyclone was

Position of centre of disturbance.

in process of formation. The centre of disturbance lay apparently immediately to the west of Ratnagiri, and the abnormal depression of the barometer off that station was at least 0·1″. The chart of the 6th showed a further development of the barometric depression

June 6th.

off the west coast. The centre appears to have moved a little to the northward of the position it occupied on the 5th, and the abnormal depression of the barometer amounted to about 0·2″. A further veering of the winds had occurred over the central portions of the sea, and a fairly complete cyclonic circulation existed. Heavy rain continued on the west coast. At noon on the 7th the disturbance

June 7th. Cyclone well developed.

was shown as a distinct and well-marked cyclonic storm. Rain was falling all over the north-east angle of the Arabian Sea, and the winds showed a well-marked cyclonic circulation, though the force

was generally not more than moderate or strong. The centre of the storm lay in Lat. 17° 20′N. Long. 71° 45′E. Normal south-westerly monsoon winds prevailed over the greater part of the Arabian Sea, and it was only in its north-east angle that the effects of the cyclone were clearly felt. The lowest barometric readings recorded on this day were 29·466″ on the *Assam* off Bombay, and 29·475″ on the *Sumatra* in the north-west quadrant of the cyclone. Readings at the centre were probably much lower. The steamers *Orion* and *Sumatra*, both apparently about 100 miles from the centre, had winds of force 7 only. The chart of the 8th showed that a further considerable development of the cyclone had occurred. The barometer near the centre had fallen at least 0·2″ and the area affected by the cyclone had considerably extended. Simultaneously with this increase of extent and intensity, the storm had commenced a brisk westerly advance, and the centre at noon was in Lat. 17° 55′N., Long. 68° 20′E. The consequence of the double action was that pressure on the west coast of India remained nearly steady. Two vessels, the *Draco* and the *Assam*, reported very low readings when near the centre on this day, the former recording 28·858″ with a strong west-south-west wind, and the latter 28·916″ with south-east squalls of hurricane force. No ship appears to have passed directly through the cyclone on this day. At noon on the 9th the intensity and extent of the cyclone was about the same as on the preceding day, but the storm had continued to move westward or rather west-north-westward, and the centre lay in Lat. 18° 30′N. and Long. 65° 20′E. Very low readings were recorded by ships which passed close to the centre on this day. Thus, the *Lorna Doone* at midnight recorded 28·86″ with a north-east hurricane; the *Assam* at 1 A.M. recorded 28·956″ with a south-east hurricane. The weather was stormy all over the centre and northern parts of the Arabian Sea.

Storm No. 51.
Position of centre.
Lowest bar. 29·47″.

June 8th.
Cyclone increasing.
Position of centre.
Lowest bar. 28·86″.

June 9th.
Position of centre.
Lowest bar. 28·86″.

The chart of the 10th showed that a rapid and considerable intensification of the cyclone had occurred during the preceding 24 hours, and that the area of disturbance had proportionately increased. The storm had continued to move west-north-westward, and the centre at noon lay in Lat. 19° 10′N. and Long. 61° 50′E. The *Albany* (noon position Lat. 19° 49′N. and Long. 60° 35′E.) to the north-west of the storm centre had a reading of 29·024″ at midnight, and all day experienced a north-west to north wind and a south-west swell. Gales of greater or less force were felt all over the centre and north of the Arabian Sea, but it is remarkable that very little rain was reported. It appears that no ship was in the immediate neighbourhood of the centre during this day. At noon on the 11th the centre of the cyclone lay in about Lat. 19° 10′N. and Long. 60° 10′E. The storm had thus moved nearly due west, and there had perhaps been some increase of its intensity. The lowest barometric pressure observed was 28·688″ on the *Albany* at 8 A.M., when

June 10th.
Cyclone intensifying.
Position of centre.

June 11th.
Position of centre.
Lowest bar. 28·69″.

Storm No. 51 *Albany* passed through centre: numerous birds and insects flew about deck.

lying on the western side of the storm. This ship entered the calm centre at about noon and experienced a dead calm for about 15 minutes, after which the hurricane burst out from south. It is important to note that the wind gradually, and not suddenly, decreased in force before the calm came on, and that numerous birds and insects flew about the ship during the calm interval. The weather cleared up rapidly after the passage of the calm centre. The *Clan Graham* well within the storm area experienced strong to terrific gales from north-west west, and west-south-west. All the other ships in the north-western part of the Arabian Sea also reported gales.

Heavy rain.

Rain appears to have been very general over the east and north of the Arabian Sea, several of the ships reporting torrential rain.

June 12th. Storm crossed Arabian coast and probably broke up.

After noon on the 11th or during the forenoon of the 12th, the storm centre probably crossed the Arabian coast, though the weather over the northern half of the Arabian Sea during the 12th was still stormy. The following table shows the position and rate of motion of the storm on each day of its existence :—

Position of centre, and rate of motion each day.

Date.	Position.		Direction of movement.	Distance travelled since noon previous day.	Rate per hour.
	Latitude N.	Longitude E.			
1887.	° ′	° ′		Miles.	Miles.
June 7th	17—20	71—45	...	...	...
„ 8th	17—55	68—20	N. 82° W.	240	10
„ 9th	18—30	65—20	N. 77° W.	200	8·3
„ 10th	19—10	61—50	N. 78° W.	240	10
„ 11th	19—10	60—10	W.	111	4·6

October 1887. Originated over Bay. Travelled north-westward and then north-eastward.

Storm No. 52.—A cyclone formed over the western half of the Bay on the 8th of October 1887. It crossed the Madras coast early on the morning of the 9th, and advanced to the west coast near Karwar by the morning of the 10th. It is doubtful if the centre actually crossed the Ghâts, but an area of low pressure and of unsettled weather travelled up the west coast between the 11th and 12th, and then recurved to the north-eastward, and passed into Khandeish, and the Central and North-Western Provinces of India. Strong squally winds and heavy rain were experienced on the west coast, but there was no gale in the Arabian Sea. The following are the extracts of logs on which the information regarding this storm is founded :—

1887.						
October 10th	*Landaura*	Aleppi .	N.-W. 3	29·88	79	Squally and showery.
	Goa .	Cochin .	S.-W.-W.	29·86	84	Squally.
„ 11th	*Landaura*	Do. .	S.-S.-E.	29·88	79	Squally, heavy south-west swell, heavy rain.
	Goa .	Calicut .	S.-E.	...	...	.....
„ 12th	*Landaura*	Cochin .	S.-W.	29·94	80	Light wind, fine.
	Goa .	Tellicherry	S.-E.	29·89	81	Light wind, cloudy.

Storm No. 52

This disturbance is only of importance as an illustration of a tendency which storms crossing the Peninsula at this season have, to recurve to the northward and subsequently to the north-eastward.

Storm No. 53. November 1888. Pl. LIII. *Reference*—Cyclone Memoirs, Vol. III, page 187.

Storm No. 53.—This storm (November 4th to 10th, 1888), which was of a somewhat complicated character, will be found fully described in the Cyclone Memoirs, Vol. III. This storm reached Madras on the evening (about 10-30 P.M.) of the 31st October. On that day in the Arabian Sea the weather was unsettled. Over the north and centre moderate to strong north-east winds were blowing, and over the south strong south-west winds. Between these two regions there was apparently an area of variable winds and squally weather.

Weather over Arabian Sea

The storm, when it crossed the Madras coast, was moving at a rate of about 10 miles per hour. By 8 A.M. on the 1st November, the centre lay in Lat. 13° 30′N., and Long. 79°E., its rate of motion since crossing the coast having been not more than 8 miles per hour. Observations at 4 P.M. on the same day (1st) show that the centre had not changed its position. The observations over the Arabian Sea show the continuance of a large area of squally, perhaps stormy, weather over the centre of the Arabian Sea. The winds there were the same as on the 31st, and it is evident that this squally area was in no way connected with the storm lying over the centre of the Peninsula, as the weather on the Bombay coast was fine with light winds.

Weather over the Peninsula.

Weather over Arabian Sea.

The following are the data giving the information on which the positions of the centre have been determined :—

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1888.		° ′	° ′				
Nov. 1st.	*Assyria*	Karachi		N.	30·033	...	Light breeze and fine weather.
,, ,,	*Lalpoora*	7—26	77—38	W.-N.-W.	29·764	...	Strong breeze and fine weather.
,, ,,	*Manora*	7—43	75—38	W.	29·90	...	Light airs and fine.
,, ,,	*Oriental*	11—12	51—54	N.-N.-E.	29·95	...	Moderate wind and fine, clear weather.
,, ,,	*Columbus*	12—26	62—34	N.-W.	29·66	...	A. M. blowing hard and thick with rain, heavy sea. Noon, clear weather.
,, ,,	*Clyde*	14—33	53—26	N.-E. 3 to 4	30·004	...	Moderate breeze and fine throughout.
,, ,,	*Serapis*	14—46	55—13	N.-N.-E. 2 to 3	29·941	...	.....
,, ,,	*Avocat.*	15—2	66—37	E.	...	...	P. M. fresh south-west breeze; very rough sea, and very hard squalls.
,, ,,	*Dalhousie*	15—11	57—41	N.-E. 4	29·91	...	Moderate north-east swell.
,, ,,	*Baghdad.*	15—20	56—20	N.-N.-W.	29·905	...	Moderate breeze and sea; fine, clear weather.

Storm No. 53.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1888.		° ′	° ′				
Nov. 1st.	*Inchbourne* .	15—28	57—18	N.-E.	29·892	...	Strong winds and clear, with heavy swell from the north-east.
,, ,, .	*Castor* . .	17—18	71—4	N.-E.	29·846	...	Light breeze from east.
,, ,, .	*City of Canterbury* .	17—37	66—56	E.-N.-E. 4	29·89	...	Rolling violently in confused cross sea.
,, ,, .	*Mishowen Head* .	18—35	67—57	N.-E.	...	...	Fresh breeze and fine clear weather.
,, ,, .	*Drumbarlie* .	?	?	N.-E.	...	...	Light breeze, cloudy weather, with head swell.
,, 2nd.	*Patna* . .	5—54	80—29	Variable	...	...	Heavy rain at times.
,, ,, .	*Manora* .	Colombo		W.-S.-W.	...	...	.....
,, ,, .	*Lalpoora* .	9—51	75—44	Variable	29·79	...	Heavy rain; light to moderate breeze.
,, ,, .	*Oriental* .	12—20	48—37	Calm	29·97	...	Fine.
,, ,, .	*Avocat* .	13—03	63—34	S.-W.	...	...	Rough sea.
,, ,, .	*Columbus* .	13—52	64—10	S.-E.	...	...	Light airs.
,, ,, .	*Maria* . .	13—59	69—16	N.-N.-W.	...	...	Squalls.
,, ,, .	*Baghdad* .	14—14	52—40	W.	29·90	...	Light to moderate breeze, fine weather.
,, ,, .	*Dalhousie* .	14—20	54—6	N.-N.-E. 4 to 5.	29·83	...	Showery.
,, ,, .	*Drumbarlie* .	15—28	57—35	E.-N.-E.	29·49	...	Strong wind and high cross sea.
,, ,, .	*Serapis* .	15—36	59—3	E.-N.-E. 7 to 5.	29·76	...	Fine.
,, ,, .	*Clyde* . .	15—40	57—30	N.-E. 6 to 7	29·80	...	High easterly swell and confused sea.
,, ,, .	*Inchbourne* .	15—53	59—23	E.-N.-E.	29·69	...	Strong wind and clear.
,, ,, .	*Canara* .	16—21	73—13	S.-E.	29·77	...	Fine weather and light breeze.
,, ,, .	*Nurjahan* .	16—40	73—8	N.-E.	29·87	...	Gentle breeze and cloudy weather, south-west swell.
,, ,, .	*Castor* . .	17—57	72—1	N.-E.	29·83	...	Light breeze, clear weather.
,, ,, .	*Coconada* .	Near Mormugao.		...	29·84	...	Fresh breeze, overcast and squally.
,, ,, .	*Knight Errant*	18—48	72—30	W.	...	...	Moderate breeze, sea smooth.
,, ,, .	*MishowenHead*	18—55	72—8	N.-E.	...	...	Moderate wind and fine.
,, ,, .	*Yesso* . .	19—27	71—3	N.-E.	...	...	Moderate and clear.
,, ,, .	*Henzada* .	23—9	64—43	N. 3	...	...	Fine weather.
,, ,, .	*urulia* .	23—41	58—32	S.-E.	30·00	...	Ditto.
,, ,, .	*Assyria* .	24—47	66—30	Calm	30·00	...	Fine weather; sea smooth and light airs.
,, 3rd .	*Avocat* . .	10—47	60—58	S.-W.	...	...	Fresh south-westerly breeze, rough sea.
,, ,, .	*Baghdad* .	13—1	49—4	N.-N.-W.	29·87	...	Light head wind and clear weather.
,, ,, .	*Lalpoora* .	13—2	74—12	E.	29·85	...	Light continuous rain at noon.
,, ,, .	*Berenice* .	13—8	47—28	...	...	...	Very clear, winds light and variable.
,, ,, .	*Idor Idar* .	13—10	48—32	Calm	...	...	Light airs and clear.
,, ,, .	*Graham* .	13—21	49—9	W.	29·85	...	High north-easterly swell, clear weather, light and variable winds.
,, ,, .	*Canara* .	13—30	74—29	W. S. W. strong.	29·84	...	Dull, cloudy, moderate sea.
,, ,, .	*Nurjahan* .	13—32	74—18	S.-S.-W. 4	29·84	...	Cloudy, light south-south-westerly sea.
,, ,, .	*Dalhousie* .	13—58	50—58	W.-N.-W. 3 to 4.	29·84	...	Long south-east swell, south-westerly winds during the afternoon.

Storm No. 53.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1888.		° ′	° ′				
Nov. 3rd.	*Columbus* .	14—5	64—52	N.-N.-W.	29·92	...	Fine clear weather, smooth sea.
,, ,, .	*Maria* . .	15—7	70—5	E.-N.-E.	...	...	Stormy, with rain.
,, ,, .	*Drumbarlie* .	16—15	61—14	N.-E.	29·89	...	Light breeze and clear.
,, ,, .	*Inchbourne* .	16—40	62—4	E.	29·90	...	Light breeze and fine.
,, ,, .	*Serapis* .	16—47	63—1	E.-N.-E. 2	29·90	...	Moderate breeze, clear sky.
,, ,, .	*Clyde* . .	17—8	61—48	N.-E. by E. 4	29·93	...	Fine clear weather.
,, ,, .	*Coconada* .	16?	74?	S.	29·81	...	Light breeze, dark gloomy weather.
,, ,, .	*Bushire* .	Moored off Cross Island Bay		...	...	...	Moderate breeze and fine.
,, ,, .	*Knight Errant*	17—58	68—13	N.	...	...	Moderate breeze and fine weather.
,, ,, .	*Castor* . .	18—38	72—22	Variable	29·82	...	Light breeze and clear weather, squally in evening.
,, ,, .	? . .	Off Muscat		S.-E.	...	...	Light breeze and fine.
,, ,, .	*Apollo* . .	18—49	72—42	N.	...	...	Fine weather, variable winds during afternoon.
,, ,, .	*Assyria* .	25—2	62—56	N.-W.	29·97	...	Fine clear weather, light breeze.
,, ,, .	*Henzada* .	20—57	61—54	N. 2	29·97	...	Light fair wind and fine clear weather.
,, ,, .	*Yesso* . .	21—13	67—10	...	...	...	Smooth sea, fine clear weather.
,, ,, .	*Manora* .	Colombo		W.-S.-W.	29·95	...	.....
,, ,, .	*Pachumba* .	Mandavi		N.-E.	29·90	...	Showery.
,, 4th .	*Lombardy* .	5—8	82—26	W. 4 to 5	29·93	...	Cloudy, heavy squalls in morning.
,, ,, .	*Avocat* .	8—19	58—0	S.-W. 4	...	...	Fresh breeze.
,, ,, .	*Canara* .	Tellicherry		S.-E.	29·90	...	Moderate breeze.
,, ,, .	*Nurjahan* .	Ditto		S. 2	29·90	...	Passing clouds, gentle breeze.
,, ,, .	*Dalhousie* .	13—4	47—32	S.-E. 2	29·89	...	Winds light and variable, sea smooth, moderate south-east swell.
,, ,, .	*Othello* .	13—23	49—24	N.-E.	29·90	...	Strong wind and sea.
,, ,, .	*Graham* .	13—31	51—38	N.-E.	29·90	...	Fresh wind and cloudy.
,, ,, .	*Idar* . .	14—2	52—29	N.-E.	...	...	Fine weather, fine breeze.
,, ,, .	*Columbus* .	14—44	66—1	N.	29·82	...	Very squally weather, blowing excessively hard, heavy head sea.
,, ,, .	*Bushire* .	16—50	73—7	S.-S.-W.	29·85	...	Dull weather and gloomy, fresh breeze, winds variable in morning.
,, ,, .	*Castor* . .	Bombay Harbour		Variable	29·85	...	Light breeze and cloudy, squally in evening.
,, ,, .	*Knight Errant.*	17—3	63—55	N.	...	...	Moderate breeze, fine clear weather.
,, ,, .	*Drumbarlie* .	17—3	65—18	N.-W.	29·84	...	Fresh breeze, with head sea.
,, ,, .	*Inchbourne* .	17—26	65—24	E.-N.-E.	...	...	Strong winds, with heavy sea.
,, ,, .	*Maria* .	17—30	70—40	E.	...	...	Squally.
,, ,, .	*Serapis* .	17—43	67—31	N.-E. 4	29·80	...	Calm.
,, ,, .	*Apollo* . .	18—8	68—37	S.-E.	...	...	Moderate variable winds, overcast, cross swell from north-east and south-east.
,, ,, .	*Clyde* . .	18—10	67—13	N.-E.	29·84	...	Moderate to fresh, unsettled monsoon, and overcast.

Storm No. 53.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1888.		° ′	° ′				
Nov. 4th	*Lawada* .	18—38	72—40	N.-E.	29·84	...	Light breeze and cloudy sky.
,, ,, .	*Hazara* .	22—14	68—38	E. 2 to 3	29·88	...	Moderate breeze, smooth sea, pleasant weather.
,, ,, .	*Pachumba* .	22—30	70—30	N.	29·88	...	Light wind and fine.
,, ,, .	*Purulia* .	24—2	61—33	S.-E.	29·91	...	Fine, clear weather.
,, ,, .	*Assyria* .	24—15	60—38	Calm	29·94	...	Smooth sea and fine weather.
,, ,, .	*Siam* . .	?	?	N.-N.-E.	29·89	...	Light breeze.
,, ,, .	*Henzada* .	19—8	59—42	N.	29·93	...	Light, fair winds and fine, clear weather.
,, ,, .	*Patna* . .	Off Tuticorin		W.-N.-W. 4	29·93	...	Light variable winds, and cloudy and fine.
,, ,, .	*Coconada* .	South of Ratnagiri		N.-E.	29·85	...	Light breeze, squally in evening.
,, ,, .	*Lalpoora* .	16—8	73—16	S.-E.	29·85	...	Light winds, clear.
,, ,, .	*Baghdad* .	Aden		E. 2	...	...	Fine, clear weather.
,, 5th .	*Avocat* . .	5—43	54—58	S.-W.	...	...	Sea smooth, very light winds.
,, ,, .	*Lombardy* .	6—43	78—52	W. 3-4	29·93	...	Moderate wind and cloudy, with occasional showers.
,, ,, .	*Nurjahan* .	Cochin		S.	...	...	Light breeze.
,, ,, .	*Canara* .	Ditto		S.	...	...	Ditto.
,, ,, .	*Siam* . .	Off Aden		N.-N.-E. 4	29·87	...	Moderate breeze and fine.
,, ,, .	*Berenice* .	13—57	51—39	N.-E. 2	29·95	...	.....
,, ,, .	*Othello* .	14—16	52—38	E.-N.-E.	29·94	...	Light wind and fine weather.
,, ,, .	*Graham* .	14—22	56—12	N.	29·93	...	Light wind and fine, clear weather.
,, ,, .	*Columbus* .	14—48	66—18	N.-W.	29·64	...	Blowing very hard, heavy sea; foggy weather, heavy squalls, with rain, at 2 P.M.; wind inclining to westward, gale increasing to a hurricane, barometer falling 29·22″, heavy squalls, with intermittent calms in the afternoon.
,, ,, .	*Idar* . .	15—25	57—20	N.	...	...	Light breeze and fine weather.
,, ,, .	*Lawada* .	15—50	73—20	S.-E.	29·87	...	High south-west swell, squally, fresh breeze.
,, ,, .	*Bushire* .	Goa		S.	...	...	Fine, but cloudy.
,, ,, .	*Knight Errant*	16—5	59—52	N.-N.-W.	...	...	Light breeze and fine, clear weather, smooth sea.
,, ,, .	*Apollo* . .	17—30	64—30	N.-N.-E.	...	...	Fresh breeze.
,, ,, .	*Drumbarlie* .	17—53	69— 4	E.	29·69	...	Strong winds, with high cross sea, squalls of heavy rain.
,, ,, .	*Inchbourne* .	18— 3	68—24	E.-N.-E.	29·74	...	Strong winds, with heavy rain and very threatening appearance, much lightning, south-east swell.
,, ,, .	*Pachumba* .	Off Bombay		S.	29·89	...	Light airs and fine.
,, ,, .	*Lalpoora* .	Bombay		Variable	29·90	...	.....
,, ,, .	*Coconada* .	Do.		E.	29·88	...	Light breeze, with continuous rain.
,, ,, .	*Serapis* .	18—34	71—45	E.-S.-E. 3	29·84	...	Smooth sea.

Storm No. 53.

DATE.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	WEATHER REMARKS.
1888.		° ′	° ′				
Nov. 5th.	*Clyde* . .	18—51	72—33	E.-S.-E.—E. 2.	29·89	...	Light breeze, fine.
,, ,, .	*Hazara* .	19—50	71—24	S.-E. 3	29·88	...	Light breeze, dull weather, passing clouds, moderate swell.
,, ,, .	*Assyria* .	Near Muskat		S.-W.	29·95	...	Light breeze and fine weather.
,, ,, .	*Henzada* .	17—20	57—34	W.-S.-W. 2	29·94	...	Gentle breeze and fine clear weather.
,, ,, .	*Maria* .	19— 0	71—42	E.-S.-E.	...	...	Variable winds, with squalls.
,, ,, .	*Imperator* .	14—35	52—50	E.-N.-E. 1	29·95	...	Slight sea from east-north-east.
,, ,, .	*Patna* .	Off Tuticorin		...	...	...	Calm and fine clear weather.
,, 6th	*Nurjahan* .	Near Aleppi		S. 1 to 2	...	...	Light airs.
,, ,, .	*Lombardy* .	9—13	76—9	N.-N.-W. 2 to 3.	29·94	...	Light winds and fine.
,, ,, .	*Lawada* .	13—9	74—31	S.-E.	29·91	...	Fresh breeze and cloudy sky, moderate west swell.
,, ,, .	*Siam* . .	13—16	47—37	N.-E.	29·95	...	Moderate wind and fine.
,, ,, .	*Arcadia* .	13—24	48—30	E. 2	29·95	...	Light head wind and fine.
,, ,, .	*Othello* .	15—4	56—21	E.-N.-E.	29·90	...	Light wind and fine weather.
,, ,, .	*Knight Errant*	15—5	55—47	N.-W.	...	...	Light breeze and fine, clear weather.
,, ,, .	*Columbus* .	15—14	67—23	W.-S.-W.	29·68	...	Thick clouds, moderate gale and sea, with intermittent squalls.
,, ,, .	*Graham* .	15—25	59—18	N.-E.	29·91	...	Fine, clear weather.
,, ,, .	*Apollo* . .	15—54	56—42	N.	29·91	...	Moderate breeze and fine weather.
,, ,, .	*Idar* . .	16—28	62—3	N.	...	...	Brisk breeze and fine weather.
,, ,, .	*Inchbourne* .	18—39	71—41	Variable	29·79	...	Strong winds and cloudy, with heavy rain.
,, ,, .	*Arabia* .	21—9	69—53	N.-W.	29·89	...	Cloudy sky.
,, ,, .	*Assyria* .	Near Jask		N.-W.	29·99	...	Light breeze and fine weather.
,, ,, .	*Henzada* .	15—54	54—2	W. & N.	29·94	...	Gentle breeze and fine, clear weather.
,, ,, .	*Patna* . .	9—1	76—26	Variable	29·96	...	Light variable winds, and fine, clear weather.
,, ,, .	*Drumbarlie* .	Off Bombay		E.	...	...	Fine, clear weather.
,, ,, .	*Canara* .	8—35	78—15	S. by W.	...	...	Moderate winds, smooth sea.
,, ,, .	*Imperator* .	15—53	58—9	N.-E. 1	29·90	...	Heavy sea from east-north-east.
,, ,, .	*Berenice* .	14—52	55—58	N.-E. 1	...	...	Light swell.
,, 7th	*Taif* . .	4—4	66—36	...	...	...	Light breeze and fine.
,, ,, .	*Canara* .	7—26	79—26	S.-W.	29·90	...	Clear weather.
,, ,, .	*Nurjahan* .	Tuticorin		N.-W. 1	...	...	Light airs and fine.
,, ,, .	*Lawada* .	10—11	75—45	S.-E. light	29·93	...	Fine weather.
,, ,, .	*Lombardy* .	12—55	74—37	E.-S.-E. 2 to 3	29·90	...	Light wind and fine.
,, ,, .	*Siam* . .	14—2	52—0	Calm	29·90	...	Fine weather.
,, ,, .	*Knight Errant*	14—10	55—25	Variable	...	...	Light airs and fine.
,, ,, .	*Columbus* .	15—39	68—28	S.-S.-E. fresh	29·78	...	Heavy sea.
,, ,, .	*Apollo* . .	15—54	56—41	N. light	...	...	Fine weather.
,, ,, .	*Othello* .	15—55	59—52	N.-N.-E. fresh.	29·89	...	Ditto.
,, ,, .	*Graham* .	16—6	62—52	N. fresh	29·79	...	Cloudy weather, confused sea.

Storm No. 53

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1888.		° ′	° ′				
Nov. 7th.	*Idar* .	17—31	66—2	N.-N.-E.	29·78	...	Fresh gale.
,, ,, .	*Purulia* .	Near Karachi		S.	29·94	...	Fine clear weather.
,, ,, .	*Assyria* .	Abbas Bunder		N.-W.	29·99	...	Ditto.
,, ,, .	*Henzada* .	14—18	50—24	Calm	29·94	...	Ditto.
,, ,, .	*Arabia* .	Karachi		W.	29·84	...	Moderate breeze.
,, ,, .	*Imperator* .	17—0	63—34	N.-E. 3	29·79	...	Agitated sea.
,, ,, .	*Berenice* .	15—51	60—19	N.-N.-E. 3	...	...	.....
,, 8th .	*Lawada* .	7—31	77—43	S.-W.	29·94	...	Light breeze, smooth sea.
,, ,, .	*Siam* .	15—4	56—39	N.-N.-E. 3	29·87?	...	Light breeze and fine.
,, ,, .	*Apollo* .	15—26	52—43	N.	29·91	...	Ditto ditto.
,, ,, .	*Berenice* .	16—41	64—20	N.-N.-E. 3	29·83	...	Light wind and cloudy.
,, ,, .	*Lombardy* .	16—26	73—10	S.-S.-E. 2to3	29·90	...	Ditto ditto.
,, ,, .	*Arcadia* .	16—36	60—46	E.-N.-E. 4	29·85	...	Moderate and fine.
,, ,, .	*Othello* .	16—38	63—2	N.-W.	29·83	...	Light wind, overcast, heavy sea.
,, ,, .	*Graham* .	16—44	65—53	N.-W.	29·83	...	Light wind, overcast, heavy sea.
,, ,, .	*Loodiana* .	17—15	72—54	S.-S.-E.	29·92	...	Overcast, showery.
,, ,, .	*Imperator* .	17—40	65—59	N.-N.-W. 3	29·84	...	Heavy sea.
,, ,, .	*Bushire* .	18—0	72—52	S.-E.	29·90	...	Light breeze and fine weather.
,, ,, .	*Idar* .	18—1	68—41	N.-W.	29·39	...	Cyclonic gale.
,, ,, .	*Columbus* .	18—9	70—42	S.-E.	29·82	...	Fresh breeze.
,, ,, .	*Calder* .	Near Bombay		Variable	29·90	...	Moderate breeze.
,, ,, .	*H. Bolchknow*	20—22	50—54	N.-N.-E.	29·96	...	Ditto to fine.
,, ,, .	*Pachumba* .	Gulf of Cambay.		S.-W. by S.	...	...	Light wind, with passing clouds.
,, ,, .	*Purulia* .	21—49	69—11	E.-S.-E.	29·86	...	Moderate breeze and cloudy, long southerly swell.
,, ,, .	*Coconada* .	Off Ratnagiri		W.	29·92	...	Fresh breeze and squally weather.
,, 9th .	*Othello* .	17—15	66—19	N.-W.	29·92	...	Light wind.
,, ,, .	*Graham* .	17—52	69—21	S.-W. light	29·96	...	Clear weather; decreasing sea in the afternoon.
,, ,, .	*Arcadia* .	17—54	66—55	N. 2	29·83	...	Fine, clear weather.
,, ,, .	*Idar* .	18—52	71—34	S.-S.-W.	29·78	...	Weather clearing, sea smooth.
,, ,, .	*Purulia* .	19—48	71—49	S.	29·82	...	Gale moderating.
,, ,, .	*Calder* .	20—32	69—34	S.-E.	29·78	...	Moderate gale, with high confused sea and heavy squalls.
,, ,, .	*Hampstead* .	20—21	70—36	S.	...	...	Strong wind and heavy sea.
,, ,, .	*Pachumba* .	Off Verawal		S. by W.	29·76	...	Squalls of cyclonic force.
,, ,, .	*Comilla* .	30 miles off Bombay		S.-E.	29·90	...	Fine clear weather.
,, ,, .	*Columbus* .	19—23	...	S.	29·86	...	Fine weather.
,, 10th .	*Ludhiana* .	10—5	67—44	S.	29·96	...	Light air, fine clear weather.
,, ,, .	*Siam* .	16—57	65—11	N.-N.-E. 3	29·91	...	Light breeze and fine.
,, ,, .	*Calder* .	21—32	67—44	N.-W.	29·91	...	Decreasing wind, weather improving.
,, ,, .	*Hampstead* .	22—41	67—24	N.	...	...	Light breeze and fine clear weather.
,, ,, .	*Comilla* .	22—48	69—12	S.-E.	29·96	...	Fine weather.
,, ,, .	*Pachumba* .	Mandavi		N.	29·95	...	Light air and fine.

November 2nd.

On the morning of the 2nd the observations indicated a somewhat irregular cyclonic circulation and area of depression off the Malabar coast, but this depression was not the direct continuation of the storm

Storm No. 53.

Weather over Arabian Sea.

which was shown between Cuddapah and Bangalore on the previous evening, and which had probably broken up. The observations of the 2nd over the Arabian Sea showed the same general conditions as on the 1st, but in the centre of the sea the weather was even more stormy than on the previous day. There was thus a marked tendency towards the establishment of a cyclonic storm, but the disturbance up to this date was of that diffused character which marks the initial stages of a cyclone. The observations of the 3rd apparently indicated that a small area of depression lay off the west coast and was moving northward almost parallel to the coast, and at the same time there was also shown a shallow area of depression in about Lat. 14°N. and Long. 52°E. It is probable that a trough of relatively low pressure, representing the large area of squally weather previously noticed, extended between these two depressions. The western depression was probably a cyclonic storm, developed under the favourable conditions noticed above; the eastern depression probably represented the effect due to the westward transmission of the general disturbance originating out of the storm which passed Madras on the evening of the 31st (October) and its absorption into the area of disturbance previously existing in the Arabian Sea.

November 3rd.

November 4th.

November 5th.

November 6th.

November 7th. Centre began to move.

November 8th.

November 9th.

The observations of the 4th showed that a large shallow depression extending from Long. 62°E. to the Bombay coast and from Lat. 12°N. to Lat. 18°N. The centre of this depression was in about Lat. 16°N., Long. 68°E. The disturbance was still diffused and irregular. On the 5th the centre of depression over the Arabian Sea was very nearly in the same position as on the 4th, *viz.* Lat. 16°N., Long. 68°E. The depression was, however, intensifying and developing into a severe cyclonic storm, but owing to the fact that it was concentrating, the weather outside the storm area was improving. On the 6th the disturbance beyond covering a smaller area than on the previous day was unchanged in character or intensity. The centre still lay in Lat. 16°N. and Long. 68° 30′E. On the 7th the observations showed apparently that the depression had moved a little distance westward, but later in the day the centre commenced to travel northward, and by midnight had reached Lat. 17° 45′N. Stormy weather and a cyclonic circulation was experienced by the few ships in the neighbourhood of the disturbance. The chart of the 8th showed that a slight further northerly movement had occurred, but it was not possible to fix the exact position of the storm centre at noon on this day, as the only vessel which was near the centre did not record her position. The storm was one of very considerable intensity, but was of small extent, so that at distances of 100 to 150 miles from the centre the winds were only force 4 (Beaufort scale). Later in the day (4 P.M.) the wind increased quickly on the Kattiawar coast, and during the night blew with the force of a gale. On the 9th at about 8 A.M. the centre of

Storm No. 53.

Position of centre and rate of motion each day.

the storm crossed the Kattiawar coast, and by noon, when the storm was quickly filling up, it lay over Central Kattiawar.

The following table shows the position and rate of motion of the storm :—

Date.	Position of Centre.		Direction of motion.	Distance travelled since noon of previous day.	Rate per hour.
	Latitude N.	Longitude E.			
1888.	° ′	° ′		Miles.	Miles.
Nov. 4th	16— 0	68— 0	...	...	...
,, 5th	16— 0	68— 0	...	...	...
,, 6th	16— 0	68— 0	...	...	...
,, 7th	16—30	67— 0	W.-N.-W.	80	3·3
,, 8th	18—40	68—33	N.-E. by N.	203	8·5
,, 9th	22—17	70—52	N.-E. by N.	297	12·4

Storm No. 54. June 1889. Pl. L.

Formed off west coast, India.

Storm No. 54.—On the 1st of June 1889 steepish gradients prevailed, and a fairly strong monsoon was blowing over the southern half of the Arabian Sea off the west coast of India, where a large area of uniform and relatively low pressure existed. On the southern side of this area strong south-westerly winds prevailed; on the western side moderate north-westerly winds and on the northern side calms and light variable airs. The centre of this low pressure area was apparently in Lat. 14°N. and Long. 70°E., but so far as the observations show, there was no indication of what could be described as a storm centre.

The following are the data giving the information on which the positions of the centre have been determined :—

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1889.		° ′	° ′				
June 1st .	*Berenice* .	18—37	72—16	Calm	29·71	91	.....
,, ,, .	*Apollo* . .	16—53	64—23	Do.	29·80	91	Light variable airs.
,, ,, .	*Elliot* . .	4—28	54—9	S.-S-.W. 4	30·16	...	Fine.
,, ,, .	*Oriental* .	18—0	68—51	N.-E. 2	29·84	88	.....
,, ,, .	*Himalaya* .	11—50	74—58	S.-W. 7	29·73	83	A.M. strong breeze, rain squalls ; P.M. moderate gale, incessant rain.
,, ,, .	*Thibet* . .	7—10	78—18	W. 5	29·81	84	Strong monsoon, high sea.
,, ,, .	*Oriental* (2) .	17—30	72—54	Variable	29·87	80	Light breezes; P.M. heavy swell.
,, ,, .	*Clan Forbes* .	13—14	54—55	S. 5	29·83	88	Fresh monsoon, heavy swell.
,, ,, .	*Honysbyrd* .	11—38	65—30	N.-N.-W. 4	29·80	...	Squally.
,, ,, .	*Satara* . .	At Lingah		Variable	29·72	92	Light wind and fine.
,, ,, .	*Peshwa* .	7—34	79—20	W.-S.-W. 6	29·84	84	Strong wind, heavy sea.
,, ,, .	*Persia* . .	13—4	47—39	W.	29·82	?98	Fine.
,, ,, .	*Kaveri* . .	11—9	58—47	E.-S.-E. 6	29·96	79	Squally, with rain.
,, ,, .	*Hazara* .	12—48	43—22	S.-E. 4	29·80	...	.....
,, ,, .	*Taif* . . .	13—25	71—0	S.-W. 7	...	...	A.M. moderate gale ; P.M. fresh gale, high sea.

Storm No. 54.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1889.		° ′	° ′				
June 2nd.	*Apollo*	17—52	68—13	S.-W. 4	29·79	95	Southerly swell.
,, ,,	*Elliot*	5—49	56—43	S.-W. 4	?30·11	...	Moderate wind, fine.
,, ,,	*Oriental*	Bombay.		S.-W. 2	29·75	90	Light wind and fine.
,, ,,	*Himalaya*	13—48	74—6	S. 5	29·71	78	Heavy squalls, S.-W. swell.
,, ,,	*Thibet*	9—14	75—57	N.-N.-W. 3	29·85	86	A.M. N.-W. swell; P.M. heavy squalls, E. to N.-E.
,, ,,	*Oriental* (2)	Mormagao		S.-E. 6	(?)29·92	82	Heavy swell, rain squalls.
,, ,,	*Clan Forbes*	14—14	58—27	W.	29·73	88	P.M. wind strong and rising, looks like bad weather.
,, ,,	*Honysbyrd*	13—32	66—57	W.-N.-W. 6	29·76	...	Rain squalls.
,, ,,	*Peshwa*	Tuticorin		W. 5	29·77	86	Fine.
,, ,,	*Persia*	13—54	51—43	W.-S.-W. 3	29·82	89	Southerly swell.
,, ,,	*Kaveri*	8—19	59—24	S.-E. 4	29·96	82	Moderate wind, overcast.
,, ,,	*Hazara*	At Aden		S.-W. 2	?	91	Fine.
,, ,,	*Karagola*	At Bombay		W.-S.-W. 4	29·76	84	Do.
,, ,,	*Akbar*	13—9	47—35	S.-S.-W 3	29·90	83	Do.
,, ,,	*Taif*	11—18	70—16	W.-S.-W. 9	...	...	A.M., fresh gale; heavy gale after noon.
,, ,,	*Teheran*	15—30	73—20	S.-E. 4	29·79	83	Moderate to fresh wind, heavy rain.
,, ,,	*Deramore*	15—39	71—10	N.-E. 6	...	...	Strong squalls, much rain.
,, ,,	*Java*	17—15	72—50	S. 4	29·79	92	A.M. moderate; P.M. strong gale.
,, 3rd.	*Apollo*	18—39	72—7	N. 3	29·69	90	.....
,, ,,	*Elliot*	7—28	59—20	S.-W. 5	?30·06	...	.....
,, ,,	*Purulia*	21—20	69—30	S.-W. 5	29·66	84	Fresh wind, fine.
,, ,,	*Himalaya*	17—31	72—59	Calms	29·70	85	S.-W. swell.
,, ,,	*Thibet*	12—52	74—27	N.-W. 3	29·75	83	Light wind, considerable westerly swell.
,, ,,	*Clan Forbes*	14—41	60—35	W.-S.-W. 6	29·70	82	Strong squally wind, heavy rain.
,, ,,	*Honysbyrd*	15—20	67—47	W.-N.-W. 6	29·65	...	.....
,, ,,	*Satara*	At Isk		Variable	29·65	90	.....
,, ,,	*Persia*	14—40	55—43	W.-S.-W. 4	29·69	87	Heavy swell.
,, ,,	*Karagola*	21—57	69—8	W.-N.-W. 4	29·85	84	.....
,, ,,	*Kaveri*	5—41	60—54	S.-E. 5	29·91	80	.....
,, ,,	*Hazara*	13—48	48—35	S.-W. 4	29·75	92	Fine.
,, ,,	*Umballa*	8—20	76—56	N.-W. 3	29·84	85	Fine, high westerly swell.
,, ,,	*Akbar*	14—0	51—36	S. 4	29·80	?99	Swell rising from southward.
,, ,,	*Bushire*	16—11	73—21	S.-E. 7	29·68	76	A.M. fresh squally wind; P.M. moderate gale, S.-W. swell.
,, ,,	*Peshawar*	8—35	76—41	W. 3	29·87	84	P.M. heavy swell; rain squalls.
,, ,,	*Assam*	Aden		W.-S.-W.	29·75	89	.....
,, ,,	*Taif*	9—29	69—38	W.-S.-W. 9	...	...	Heavy gale, but fine, heavy swell.
,, ,,	*Deramore*	12—47	72—55	Variable	...	...	Light winds, heavy swell.
,, ,,	*Java*	15—13	73—18	S.-W. 10	29·69	82	4 A.M. strong monsoon, heavy swell; 8 A.M. to midnight fierce gale, heavy squalls.
,, ,,	*Teheran*	12—22	74—33	S.-W. 3	29·76	81	Heavy squalls, rain; fierce gusts of winds.
,, 4th.	*Elliot*	9—43	62—6	S.-W. 6	?30·01	...	Strong wind, sea rising.
,, ,,	*Purulia*	Bombay		E. 5	29·62	...	.....
,, ,,	*Himalaya*	Bombay		N.-W.	29·60	...	.....

Storm No. 54.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1889.		° ′	° ′				
June 4th.	*Thibet*	16—40	73—10	S.-W. 6	29·58	84	A.M. strong wind, continued rain; P.M. fresh gale.
,, ,,	*Clan Forbes*	15—44	64—1	S.-W. 5	29·63	88	.....
,, ,,	*Honysbyrd*	16—12	68—41	W.-N.-W. 9	29·525	...	A.M. severe gale; P.M. hurricane.
,, ,,	*Satara*	Muscat		N.-W. 3	29·51	100	Light wind, fine.
,, ,,	*Peshwa*	Tuticorin		S.-W. 4	29·75	84	P.M. blowing hard, raining.
,, ,,	*Persia*	15—35	59—51	W. 5	29·70	85	P.M. strong breeze from north.
,, ,,	*Karagola*	Karachi		W. 4	29·67	81	Moderate, fine.
,, ,,	*Kaveri*	2—54	61—14	S.-E. 6	29·91	80	Cloudy, heavy sea.
,, ,,	*Hazara*	15—36	52—40	S.-W. 4	29·69	90	Fine.
,, ,,	*Umballa*	10—37	75—32	Variable	29·84	85	Raining incessantly, squally, high westerly sea.
,, ,,	*Akbar*	14—42	55—35	S.-W. 6	29·76	82	Heavy westerly swell.
,, ,,	*Bushire*	Vingorla		S.-S.-W. 6	29·68	77	Strong wind, squally.
,, ,,	*Peshawar*	12—51	74—36	W.-S.-W. 4	29·82	80	Heavy westerly swell.
,, ,,	*Assam*	13—11	48—3	W.-S.-W. 3	29·72	93	Fine.
,, ,,	*Siam*	Bombay		S.-W. 2	29·58	88	Fine; P.M. high sea.
,, ,,	*Assyria*	Bunder Abbas		S.-W. 5	29·45	88	Strong head wind, S.-W. swell.
,, ,,	*Taif*	6—50	69—33	S.-W. 8	...	...	A.M. gale; P.M. decreasing wind.
,, ,,	*Deramore*	9—55	74—50	W.-S.-W. 4	...	...	Squally, high S.-W. swell.
,, ,,	*Java*	13—19	74—14	S.-W. 9	29·65	85	Monsoon gale, squally high sea.
,, ,,	*Teheran*	8—27	76—28	S.-W. 2 to 3	29·90	85	Moderate to light wind.
,, 5th.	*Elliot*	11—56	65—8	S.-W. 6	30·01	...	Midnight, 29·96, strong gale.
,, ,,	*Clan Forbes*	16—47	67—31	W. 4	29·55	86	P.M. wind increasing to gale, heavy sea.
,, ,,	*Honysbyrd*	16—35	69—29	S.-W. 12	29·44	...	Hurricane and rain squalls; 8 P.M. moderating.
,, ,,	*Satara*	Gwadur		E. 3 to 4	29·48	84	Light wind and fine.
,, ,,	*Peshwa*	8—46	76—27	N.-N.-E. 4	29·85	85	Moderate breeze, very heavy swell.
,, ,,	*Persia*	15—52	63—57	W. 3	29·66	90	Fresh to moderate breeze.
,, ,,	*Karagola*	At Karachi		S.-W. 4	29·68	84	High S.-W. swell; P.M. strong breeze and squalls.
,, ,,	*Kaveri*	0—15	62—24	S.-E. 3	29·89	85	.....
,, ,,	*Hazara*	17—29	56—44	W.-S.-W. 5 to 6.	29·67	90	Fine.
,, ,,	*Umballa*	12—57	74—21	S.-W. 4	29·78	89	Moderate to fresh wind, squally.
,, ,,	*Akbar*	15—33	59—41	W.-S.-W. 6	29·69	86	Strong wind, heavy S.-W. swell.
,, ,,	*Peshawar*	17—25	72—55	E.-S.-E. 6	29·67	81	Fresh to strong wind; squally, rain.
,, ,,	*Assam*	14—37	53—18	S.-E. 4	29·71	88	Moderate wind, fine, heavy S. swell.
,, ,,	*Algoma*	18—27	70—37	N.-E. 8	29·30	...	Gale, rising sea, heavy rain squalls.
,, ,,	*Maria Theresa*	13—6	49—34	Calm	29·71	91	Fine.
,, ,,	*Poseidon*	Bombay		...	...	...	P.M. strong increasing wind.
,, ,,	*Siam*	18—2	69—8	N.-W. 7	29·46	89	Moderate gale and high seas.
,, ,,	*Henzada*	Bombay		E. 9	29·51	86	A.M. strong gale; P.M. very high sea.

Storm No. 54.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1889.		° ′	° ′				
June 5th.	*Assyria*	24—43	64—20	W. 5	29·49	88	Strong head wind; heavy S.-W. swell.
,, ,,	*Taif*	4—20	68—32	S.-W. 4	...	...	Heavy swell.
,, ,,	*Deramore*	6—43	76—40	W.-S.-W. 4	...	...	.....
,, ,,	*Java*	12—22	74—52	S. 6	29·82	86	Strong to moderate breeze.
,, ,,	*Kohinur*	16—38	73—11	S.-S.-E. 6	29·67	...	Strong squally wind.
,, 6th.	*Elliot*	14—5	66—55	W. 8 to 9	29·76	...	Fresh to strong gale, rain squalls.
,, ,,	*Clan Forbes*	17—28	69—27	W. 8 to 9	29·48	87	Fierce to fresh gale, heavy squalls.
,, ,,	*Honysbyrd*	15—41	71—45	W.-S.-W. 4	29·55	...	.....
,, ,,	*Satara*	24—42	65—49	E. 4 to 5	29·60	89	Fresh unsteady wind, heavy S.-W. swell.
,, ,,	*Persia*	17—17	68—14	W. 5 to 6	29·62	...	Fresh to strong breezes, high sea.
,, ,,	*Karagola*	21—31	69—28	E.-N.-E. 7 to 8	29·49	86	A.M. moderate gale; P.M. hard gale; 6 P.M. 29·40; 9 P.M. 29·00; 10 P.M., 28·88; 11 P.M. 28·95; midnight 28·60, hurricane from E.
,, ,,	*Kaveri*	2—4	64—3	S. 3	29·86	86	.....
,, ,,	*Hazara*	20—19	60—10	S.-W. 2 to 3	(?)29·67	90	Moderate to fresh breeze.
,, ,,	*Umballa*	15—57	73—21	S.-W. 5	29·72	86	Light to strong westerly breeze, heavy squalls.
,, ,,	*Akbar*	16—27	63—27	W.-S.-W. 6	29·65	89	South-westerly swell.
,, ,,	*Assam*	15—50	58—38	S.-W. 5 to 6	29·71	89	Fresh monsoon, heavy south-westerly sea.
,, ,,	*Algoma*	18—30	70—0	S. 9	?29·00	...	Strong gale.
,, ,,	*Maria Theresa*	13—55	53—48	S.-E. 6	29·79	88	.....
,, ,,	*Poseidon*	18—46	71—46	S.-S.-E. 12	29·04	84	Strong gale to 9 A.M., hurricane 9 A.M. to noon; P.M. strong gale, high sea.
,, ,,	*Rufford Hall*	12—48	46—36	S. 3 to 4	29·55	88	P.M. south-westerly swell.
,, ,,	*Siam*	17—3	65—1	W. 7	29·67	91	Moderate gale, very heavy sea.
,, ,,	*Henzada*	Off Bombay		? S. 11	29·55	82	Gale, with terrific squalls.
,, ,,	*China*	24—15	66—51	S.-W. 4	29·65	...	.....
,, ,,	*Assyria*	25—8	59—39	S.-W. 2 to 3	29·46	102	Light wind, fair.
,, ,,	*Taif*	1—58	66—33	S.-W. 2 to 3	...	...	.....
,, ,,	*Java*	Narakel		S.-S.-W. 4	29·87	84	Heavy swell.
,, ,,	*Kohinur*	14—17	74—4	S.-S.-W. 5	29·68	...	Squalls.
,, ,,	*Malwa*	Off Bombay		N.-E 6.	29·40	...	.....
,, 7th.	*C. Forbes*	18—35	72—21	S. 4	29·58	85	Squally, with rain.
,, ,,	*Honysbyrd*	16—58	69—40	S.-S.-W. 4	29·57	...	.....
,, ,,	*Satara*	Off Karachi		N.-E. 5	29·39	94	A.M. heavy S.-W. swell; P.M. strong E. to S.-E. wind, threatening appearance to S.-E.
,, ,,	*Persia*	18—21	72—16	S.-W. 5	29·62	...	Strong breeze and heavy sea.
,, ,,	*Karagola*	21—31	69—28	E.-S.-E. 12	28·89	83	4 A.M., 28·67, complete hurricane; 7 P.M. moderating.
,, ,,	*Kaveri*	4—4	65—29	S.-W. 4	29·87	88	Moderate to strong breeze.
,, ,,	*Hazara*	22—43	63—37	W.-N.-W. 2	29·57	87	Moderate to strong breeze, fine.
,, ,,	*Umballa*	At Bombay		S.-S.-E. 5	29·68	...	Heavy swell.
,, ,,	*Akbar*	17—18	67—11	W. 8	29·60	85	Strong breezes to fresh gale, W. to W.-S.-W.

Storm No. 54.

Date.	Name of Ship.	Latitude N.	Longitude E.	Wind.	Barometer.	Thermometer.	Weather Remarks.
1889.		° ′	° ′				
June 8th.	*Assam* . .	16—55	63—55	W.-S.-W. 5	29·66	87	Strong breezes, easterly sea.
,, ,, .	*Algoma* .	18—30	72—0	S. 7 to 8	?29·43	...	Squally.
,, ,, .	*Maria Theresa*	14—36	58—15	S.-W. 6	29·75	88	High sea.
,, ,, .	*Poseidon* .	18—43	71—15	S.-W. 8	29·50	82	.....
							.....
,, ,, .	*Siam* . .	16—54	61—1	W.-S.-W. 8	29·65	95	Fresh to strong gale.
,, ,, .	*China* . .	21—33	69—7	N.-E. 8	29·23	...	.....
,, ,, .	*Kohinur* .	11—30	75—7	Variable	29·82	...	Frequent squalls, wind and rain.
,, ,, .	*Malwa*. .	16—59	72—42	S. 5 to 6	?29·55	84	Moderate to fresh monsoon.
,, ,, .	*Rufford Hall*	14—30	51—0	W.-S.-W.-S.-W. 4	29·55	89	P.M. S.-W. swell.
,, ,, .	*Satara* .	At Karachi		S.-S.-E. 3 to 4	29·57	90	.....
,, ,, .	*Karagola* .	20—00	70—40	S.-S.-E. 4	29·64	83	Blowing fresh and squally.
,, ,, .	*Kaveri*. .	7—20	66—17	S.-W. 6	29·86	88	Strong and squally.
,, ,, .	*Hazara* .	24—43	66—42	...	29·61	89	.....
,, ,, .	*Akbar* . .	Off Bombay		S.-S.-E. 2 to 4.	29·73	...	Light to moderate breeze, squally.
,, ,, .	*Assam* . .	18—5	69—6	S.-W. 6	29·66	88	Moderate gale; S.-W. swell.
,, ,, .	*Maria Theresa*	15—34	63—8	W.-S.-W. 7	29·63	89	Very high sea.
,, ,, .	*China* . .	20—40	70—7	S.-E. 8	29·55	...	A.M. strong gale; P.M. moderating.
,, ,, .	*Siam* . .	16—37	57—6	W.-S.-W. 7	29·60	88	Monsoon gale, heavy S.-W. swell.
,, ,, .	*Mobile* . .	20—2	70—13	S.-W. 5	29·63	90	P.M. decreasing wind.
,, ,, .	*Malwa*. .	13—14	74—22	S. 4	?29·65	85	Moderate to fresh breeze.
,, ,, .	*Rufford Hall*	16—29	55—42	S. W. 5	29·46	85	Cloudy, hazy weather, S.-W. swell.
,, 9th.	*Kohinur* .	9—11	76—22	S.-E. 2 to 3	29·84	...	Southerly high sea.
,, ,, .	*Siam* . .	15—26	53—9	W.-S.-W. 6	29·66	91	Strong monsoon, high sea.
,, ,, .	*Malwa*. .	8—48	76—22	S.-W. 2	29·73	78	Light to moderate wind.
,, ,, .	*Maria Theresa*	16—59	67—53	S.-W. 7	29·71	89	.....
,, ,, .	*Oriental* .	18—17	72—45	E. 5	29·84	84	Long heavy S.-W. swell.
,, ,, .	*China* . .	19—48	71—8	S.-S.-E. 5	29·73	...	Moderate breeze, fine, southerly swell.
,, ,, .	*Satara*. .	At Karachi		S.-S.-W. 2 to 3.	29·63	...	Very heavy S.-S. W. swell.
,, ,, .	*Peshwa* .	11—2	75—39	N.-N.-E. 5	29·85	80	.....
,, ,, .	*Kaveri*. .	9—35	66—40	...	29·85	86	.....
,, ,, .	*Chupra* .	7—41	77—40	W.-N.-W. 6	29·94	...	.....
,, ,, .	*Assyria* .	Off Lingah		N.-E. 6	29·39	99	Very heavy sea.
,, ,, .	*Mobile* . .	21—2	67—13	S.-W. 4 to 6	29·65	89	Moderating.
,, ,, .	*Rufford Hall*	19—0	59—30	N.-W. 7	29·23	85	A.M. S.-W. to W., increasing wind and sea; 1 P.M. wind W.-N.-W increasing; 4 P.M. high sea; 8 P.M. 28·80″, N.-W.8 to 9; 11 P.M. W.-N.-W. hurricane; midnight, wind drawing to S.-W., barometer rising.

June 2nd.

On the 2nd the chart showed an elongated area of low pressure stretching east and west between the parallels of 12° and 16°N. and extending from Long. 72° to Long. 60°E. From the observations it would appear that at the eastern extremity of this low-pressure area

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a storm centre was forming. The barometer had fallen slowly on board the *Honysbyrd* (Lat. 13° 32′N., Long. 66° 57′E.), and the wind had shifted to west-north-west and increased with heavy rain squalls, while the *Taif* (in Lat. 11° 18′N., Long. 70° 16′E.) had a heavy gale from west-south-west. The effects of the storm centre were, however, confined to a very small area, as the winds on the west coast of India, though blowing from an abnormal direction (south and south-south-east), were only moderate in force, while off Bombay the directions were from south-west. The barometer had fallen very slightly on the west coast of India. The centre, if a centre existed, lay on this day in Lat. 14°N. and Long. 70° 10′E. The observations of the 3rd showed that the barometer had fallen one-tenth of an inch over the western half of the Arabian Sea. They also showed that a well-marked, though slight, depression existed off the west coast of the Peninsula, the centre being apparently in Lat. 15° 35′N. and Long. 70° 10′E. The barometer had again fallen over the whole of that part of the Arabian Sea affected by the storm, and gradients had become steeper on the southern side of the depression. The wind had increased, and hard gales were reported from the *Taif* (Lat. 9° 29′N., Long. 69° 38′E.) and the *Java* (Lat. 15° 13′N., Long. 73° 18′E.). By noon on the 4th the cyclone had travelled northward to Lat. 16° 45′N. and Long. 70° 10′E. The barometer had again fallen 0·1″ throughout the storm area, and the lowest barometer reported was 29·53″ on board the *Honysbyrd* in Lat. 16° 12′N. and Long. 68° 41′E. A severe west-north-west gale was blowing on this ship all the morning, and a hurricane after noon. Both the *Java* and the *Taif* were proceeding southward, and consequently increasing their distance from the disturbance, yet they continued to report strong south-westerly gales. To the north of the disturbance the winds were light. The chart of the 5th showed that the cyclone had hardly moved its position, but had begun to curve to the north-westward, the change in its direction of advance from north to north-west having been apparently accompanied with a great retardation in its rate of advance. The barometer had again fallen nearly 0·1″ over the storm area, while it had remained nearly steady over the greater part of the Arabian Sea. In consequence the storm had intensified, and was now a considerable disturbance. The nearest ships were, the *Honysbyrd* (Lat. 16° 35′N., Long. 69° 29′E.) with a south-west hurricane and fierce rain squalls, and her barometer reading at 29·44″; the *Siam* with a north-west gale and high sea, and her barometer reading 29·46″; and the *Algoma* (Lat. 18° 27′N., Long. 70° 37′E.), with a north-east gale, a rising sea, heavy rain squalls, and her barometer reading 29·30″. A gale was also blowing on the North Konkan coast. There was no vessel close to the centre of the storm, and the lowest isobar (neglecting the doubtful reading on the *Algoma*) was 29·45″. At noon on the 6th the centre of the cyclone was apparently in Lat. 19° 0′N. and Long. 69° 30′E., so

Weather over Arabian Sea antecedent to formation of cyclone.

June 3rd. Cyclone formed.

June 4th. Cyclone moved northward.

June 5th. Cyclone curving to north-west.

Cyclone intensifying.

June 6th. Position of centre.

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that the north-westerly movement which had commenced on the previous day had continued, while the rate of motion had increased.

The precise position of the centre is somewhat doubtful, as the *Algoma*, in Lat. 18° 30′N., Long. 70° 0′E. reported 29·00″; and the *Poseidon*, in Lat. 18° 46′N., Long. 71° 49′E., 29·04″. Accepting both these readings would imply that the central area of the storm had become oval in shape, with its major axis running east and west. The geographical surroundings of the cyclone and the fact of its having advanced into the angle formed by the Konkan and Kattiawar coasts might account for this alteration of the shape, but the southerly strong gale on the *Algoma* is opposed to this conception of the form of the central area. On board the *Poseidon* a south-south-east hurricane was blowing. The other ships within the storm area were the *Henzada* off Bombay, which experienced a southerly hurricane, the *Clan Forbes*, in Lat. 17° 28′N., Long. 69° 27′E., which had a westerly strong gale, and the *Karagola*, in Lat. 21° 31′N., Long. 69° 28′E., to the north of the centre, which had an east-north-east gale at noon. The storm was advancing on a course which would lead it a little to the south of this ship, but close to it. The barometer marked 29·40″ at 6 P.M., so that the fall at this time was slow, but by 9 P.M. the mercury marked 29·00″, at 10 P.M. 28·88″, and at midnight 28·60″. At the last-named hour an easterly hurricane was blowing. The area of the Arabian Sea affected by the cyclone was much larger than on the preceding day; thus, the *Elliot*, in Lat. 14° 5′N. and Long. 66° 55′E., had a westerly strong gale, and the *Siam*, in Lat. 17° 3′N. and as far west as Long. 65°E., had a westerly moderate gale. At noon on the 7th the centre of the storm appeared to be just to the south-west of the *Karagola*, which lay in Lat. 21° 31′N. and Long. 69° 28′E., and the estimated position of the centre of the cyclone is Lat. 20° 40′N. and Long. 69° 0′E. Hence the north-westerly movement had been maintained. The *Karagola* reported a reading of 28·89″ at noon, so that the barometer had begun to rise. The *China*, in Lat. 21° 33′N. and Long. 69° 7′E., was apparently almost directly in front of the advancing storm, and at noon reported a north-easterly gale and a pressure of 29·23″. By 1 P.M. the wind had increased to hurricane force from north-east, but subsequently the direction shifted to south-east, showing that the storm had passed on north-westward. The *Akbar*, in Lat. 17° 18′N. and Long. 67° 11′E., had a westerly gale, and the *Poseidon*, in Lat. 18° 43′N. and Long. 71° 15′E., had a south-westerly gale, but the barometer was rising, and the wind moderating over the sea adjoining the west coast of the Peninsula. On the 8th the storm was apparently quickly filling up. The centre seemingly lay off the mouth of the Runn of Kutch in about Lat. 22° 30′N. and Long. 67° 42′E., but there were no ships in the immediate neighbourhood. The *China*, in Lat. 20° 40′N. and Long. 70° 7′E., had a south-easterly gale of moderate force, and her barometer had risen three-tenths of an inch, while on the other side of the storm area there

Lowest barometer 28.60″.

June 7th. Position of centre.

June 8th. Cyclone filling up.

were the *Satara* and the *Hazara*, both off the port of Karachi. The barometer in both these ships had risen since the previous day, and the winds reported were moderate, so that it may safely be concluded that the storm was filling up. A strong south-westerly monsoon was, however, blowing throughout the Arabian Sea. On the 9th the lowest pressures were off the Mekran coast, but there was no sign of a gale in that neighbourhood.

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June 9th.

The following table shows the position and rate of motion of the storm :—

Position of centre, and rate of motion each day.

Date.	Position of centre.		Direction of motion.	Distance travelled since noon previous day.	Rate per hour.
	Latitude N.	Longitude E.			
1889.	° ′	° ′		Miles.	Miles
June 1st	14— 0	70—10	...	...	...
„ 2nd	14— 0	70—10	...	...	...
„ 3rd	15—35	70—10	N.	102	4·0
„ 4th	16—45	70—10	N.	80	3·0
„ 5th	17—30	70— 0	N. by W.	51	2·0
„ 6th	19— 0	69—30	N. by W.	109	4·5
„ 7th	20—40	69— 0	N. by W.	116	5·0
„ 8th	22—30	67—42	N.-W. by N.	152	6·0

Before proceeding to the question of the average distribution in time and space of the storms described above, it may be as well here to give briefly, under different headings, the remarks which have found a place in the foregoing pages, and which may be of service in forming a correct idea of the characteristics attending the birth and life of cyclones in the Arabian Sea.

General characteristics of the weather during the period antecedent to the appearance of a cyclone.

Weather antecedent to cyclones.

The references to this period are very few. Logs which give in very complete detail the history of all the phenomena of a storm when once that storm has been formed are curiously incomplete as to the appearances and weather which preceded the approach of the gale. So much so is this the case that it is difficult to avoid the conclusion that the premonitory symptoms of a cyclone are slight, and not of so distinct a character as to enable them to be differentiated easily from non-cyclonic phenomena. Certain points have, however, been noticed in the preceding pages which it may be useful now to summarise.

Northerly winds.

One of the commonest and most noticeable of the weather phenomena which accompany the generation of a cyclone is the appearance of a freshening northerly wind in a position where, under normal conditions of pressure, a wind from this direction would be unknown. The first notice of this occurrence, quoted in the preceding descriptions, is found in the log book of the East India

Storm No. 10.

Weather antecedent to cyclones.

Storm No. 10.

Company's ship *Essex*, on the 3rd of June 1811. This ship was then in Lat. 16°38′ N. and Long. 69°32′ E. to the south-west of Bombay. In this position at this season the chance of a northerly wind is only 1 in 100. All the morning of this day the *Essex* had a light northerly wind and *fair weather*, and in the afternoon a freshening north-east wind. She subsequently experienced a severe cyclonic hurricane.

Storm No. 19.

In April 1847 a cyclone was formed over the Arabian Sea in Lat. 7°N. and Longitude 75°E. In this instance there are no records available for the days prior to the formation of the cyclone, as the *East London* apparently ran towards an already developed disturbance. Hence the north-west squalls noticed on this ship are not of the same importance as the north wind recorded before the commencement of the previous gale. It may be mentioned here that in a footnote Piddington suggests that calms had prevailed off the Laccadives between the 2nd and 13th.

Storm No. 25.

In the account of the Bombay cyclone of October and November, 1854 there is a certain amount of information respecting the weather prevailing off the west coast of India prior to the appearance of the cyclone which is interesting and instructive. The storm apparently formed in about Lat. 13°N. and Long. 72°E. In this position the average wind direction is north-west to north-north-west, with occasional shifts to north.-east. The following extracts are from the log book of the *Norwood*:—

	Lat. N.	Long. E.	
October 26th	11°48′	69°8′	Finest day for 10 days; wind N.-N.-W. to N.-E.
„ 27th	12°42′	69°43′	Ditto ; light N.-W. airs.
„ 28th	13°21	70°29′	Thunder and lightning; calms and squalls.
„ 29th	13°57′	70°42′	Thunder and lightning; much rain, wind north.
„ 30th	14°32′	70°57′	Thunder and lightning; wind flying about from all quarters. At midnight blew a gale.

The observations show that at first there was a light steady wind from north, with brilliant weather; then that thunder and lightning commenced and the weather alternated between calms and heavy squalls, with the wind flying about in all directions, after which the wind settled into a gale.

The following extracts are from the *Forfarshire* and refer to the same cyclone:—

	Lat. N.	Long. E.	
October 25th	10°47′	69°53′	Cloudy weather and much rain.
„ 26th	11°21′	69°24′	Rain, cloudy weather; light northerly wind.
„ 27th	12°1′	70°24′	Light variable N.-W. to N.-N.-W. wind with rain.

	Lat. N.	Long. E.	
October 28th	12° 30′	71° 22′	Light variable wind from N.-E.; lightning all round.
,, 29th	13° 32′	71 °51′	Wind E.-S.-E., much rain; lightning all round.
,, 30th	15° 14′	72° 44′	Moderate breeze from S.-S.-W. to S.-S. E.; heavy rain.
,, 31st, off Bombay			S.-E., strong wind.

Weather antecedent to cyclones. *Storm No. 25.*

These two ships were close together during the period of the 26th to the 29th October, but the records of weather are very different. The *Forfarshire* had rain throughout and never experienced the calms and squalls which prevailed with the *Norwood*. Both ships passed over the region where the cyclone subsequently originated, and they both experienced steady north winds prior to the appearance of the gale, but, as these winds are normal at this season of the year in this region, their appearance in this locality is not remarkable.

Storm No. 32.

Between November 19th and 23rd, 1862, a cyclone passed from the north of the Maldives on a curved course, and struck the Konkan coast to the north of Bombay. The information regarding the weather prior to the formation of the storm is, as usual, very scanty. The logs of two ships, the *Cecrops* and the *Hamoody*, state that for a week before the appearance of the cyclone there was an idea that mischief was brewing. The weather was unusually sultry; there was a long suspicious swell, without any wind; the calm oppressiveness of the weather was now and then suddenly disturbed by a heavy passing squall with torrents of rain, and at one time the *Cecrops* was surrounded by several water-spouts. At the time that these indications of unsettled conditions were recorded, however, both these ships were at the entrance to the Persian Gulf, and nearly 20° to the northward of the place of origin of the cyclone, so that it is at least doubtful whether this abnormal weather, though undoubtedly connected with the cyclone, can be said to be characteristic of the period preceding the generation of a storm.

Storm No. 44.

At the close of May 1881 a violent cyclone was formed over the Arabian Sea in about Latitude 14°N. and Longitude 66°E. The storm was formed on the 26th, and the earliest day before this date for which any meteorological information is available is the 25th, so that in this instance also there are very few facts which can be definitely considered as indicative of storm formation. The only one of importance is the northerly wind which was reported by the *Deva Gangadur* in Latitude 14° 4′N. and Longitude 64° 15′E. Northerly winds are practically unknown in this situation at this season, and in this case the northerly wind appears to have preceded the formation of the cyclone.

Storm No. 47.

The next storm of importance which formed over the Arabian Sea was the Aden cyclone of May 30th to June 3rd 1885. In this case the

Weather antecedent to cyclones. *Storm No. 47.*

data available commence some days before the appearance of the cyclone, and the northerly wind and fine weather preceding the storm are very noticeable. On the 24th the *Nianza* in Latitude 15° 10′ N. and Longitude 69° 15′E. had a north north-west wind and fine weather; on the 25th the same ship in Latitude 12°17′N. and Longitude 65° 30′ E. had a north-north-east breeze, and the *Royal George* in Latitude 15°7′N. and Longitude 72°1 8′E. had a north-north-west wind. On the 26th calms prevailed, with very hot weather, along the parallel of 14°N. from Longitude 52°E. to Longitude 72°E. To the north of this calm area northerly winds continued, while to the south, there was a freshening westerly and south-westerly wind, with fierce squalls and rain at times. This continued till the 28th, when distinct evidence of the formation of a cyclone began to appear.

These extracts show that over the northern part of the centre of the Arabian Sea there was a northerly wind and fine weather prior to the appearance of the cyclone, and a reference to the average charts of this time show that such a wind is most exceptional. After this wind had blown for some time a calm area was formed between Latitudes 12° and 14°N., and extending from Socotra to Longitude 70° E., and within this calm area the cyclone was subsequently generated.

Storm No. 48.

A few days later, on June 3rd 1885, a second cyclone was forming over the Arabian Sea. On the 4th the following ships were in the centre of the Arabian Sea:—the *Clan Graham* (in Latitude 16° 45′ N. and Longitude 63° 45′ E.) experienced north-westerly moderate breezes; the *Pharos* (in Latitude 8°3 4′ N. and Longitude 67° 7′E.) north-easterly winds and squally weather; the *Lancelot* (in Latitude 13° 42′N. and Longitude 69° 36′E.) had a north wind with thunder and lightning; and the *Knight of the Thistle* (in Latitude 11° 51′N. and Longitude 66° 32′E.) had a north-west light wind, with squalls from the same quarter. The observations of the 5th exhibit the same characteristics, *viz.* light northerly winds all over the centre of the Arabian Sea with fine weather and occasional squalls, and on the 6th the storm was formed.

For both these cyclones there is an exceptional amount of information for the period prior to the formation of the centres, and these periods are both marked by the same characteristics, *viz.* an extensive and steady abnormal northing in the winds over the centre of the Arabian Sea. These winds did not extend over the north of the Arabian Sea, but were found chiefly to the south of Latitude 16° as the *Assyria* in Latitude 25° N. and Longitude 60° E. had south-west winds.

Storm No. 54.

In June 1889 a severe cyclone was formed off the west coast of India, and in this case also the antecedent weather over the

Arabian Sea was marked by the usual abnormal northerly winds. The centre formed in Latitude 14° N. and Longitude 70° 10′ E., and was not plainly observable until the afternoon of the 2nd. Yet on the 1st the *Oriental*, in Latitude 18° N. and Longitude 69° E., had a north-east wind, and the *Honysbird* in Latitude 11° 38′ N. and Longitude 65° 30′ E. had a north-north-west wind.

Weather antecedent to cyclones. *Storm No. 54.*

There is, then, in these extracts a certain amount of evidence that the cyclones which originate in the pre-monsoon period are preceded by abnormal northerly winds, which blow southward sometimes as far as Latitude 10° N. They do not necessarily prevail over the whole region from the Baluchistan and Mekran coasts southward, the first appearance of these winds being frequently along a parallel considerably to the south of the above-mentioned coasts. In the post-monsoon period the evidence as to an abnormal strengthening of the northerly current is obscured by the fact that the average wind at this season is from some northerly point, and it is difficult to disentangle the ordinary from the abnormal current of air.

Summary.

Cyclonic phenomena observed during progress of storm.

In the foregoing pages the following important observations as to the phenomena experienced during the passage of a cyclone are noted.

Cyclonic phenomena of storms.

First, as regards the centre. The first notice of a ship's passing through the calm centre of a cyclone is found in the account of gale No. 16. The *Lady Faversham* was involved in the centre of the storm at 2-45 A.M., and emerged at 3 A.M. She entered the centre with a northerly hurricane, and emerged with a southerly hurricane. The sea within the centre was frightful. The *Whitby* entered the same centre at 9 A.M. with a north-north-east hurricane, and emerged at 10-30 A.M., or after one hour and a half, with a south-west wind. The *Ann Metcalfe* entered the same centre with a northerly gale at noon; had a calm for half an hour, and made her exit with a southerly hurricane. The periods during which these ships lay within the calm centre varied from fifteen minutes to ninety minutes. This difference can hardly have been due to variations in the size of the centre, which was probably constant, or nearly so. It is, however, important to note that each vessel seems to have passed directly across the centre, the wind directions on entering and leaving having been directly opposing. The only other remark to which attention will be called is the frightful sea prevailing within the centre. Later on the *Seaton* passed close to the centre, though not through it, and describes the weather as follows:—"The rain fell in torrents, the lightning was awful, the clouds intensely dark and resting on the surface of the sea. In the zenith there was an obscure circle of imperfect light."

Passage of central area. *Storm No. 16.*

Cyclonic phenomena of storms:—Passage of central area.

In the discussion on the next storm there occurred the following notice of the conditions prevailing within, and close to, the centre of the cyclone. The *Hindoostan* entered the centre with an easterly hurricane at midnight, and was involved in the central calm for one hour, and passed out into a southerly hurricane. The log says that the wind lulled *suddenly* to a calm.

Storm No. 17.

Storm No. 19.

In the next gale there is another similar notice. The *Buckinghamshire*, which had run northward off the west coast of India with a cyclone, got directly in front of the storm centre at about noon, and experienced a south-easterly hurricane. After noon the gale increased to an extraordinary degree; and the fore-mast and main-mast were blown out of the ship. The force of the wind was indescribable, everything exposed to its fury being blown away. At 2 P.M. the wind *suddenly* fell calm, and the ship was covered with aquatic birds, thousands of which were dying on the deck. At 4 P.M. the hurricane, which had died away at east-south-east, commenced with equal violence from west-north-west. The ship again became enveloped in the sea. There are three important points to be noticed in this extract; first, that the *Buckinghamshire*, like the vessels mentioned in storm No. 16, passed directly across the storm centre, and on emerging had the wind from a point directly the opposite of that with which she entered the centre; second, that there does not appear to have been much sea within the calm area; and third, that the ship was two hours in crossing the central calm.

Storm No. 31.

The *Typhoon*, on her voyage from Aden to Bombay, ran into the centre of a cyclone. She had had, during the early morning, an unsteady gale, till *suddenly* she ran into a calm area. Heavy dark masses of cloud rolled above, the sea rose in crested masses, and the ship was inundated with numbers of beautiful butterflies, and many species of sea-birds. The ship emerged from the centre into a furious south-west gale. This record differs from those previously given in that, though the storm was evidently a well formed cyclone, it appears that it was only on its south-east quadrant that the gales were of dangerous force. The next notice of a vessel entering the calm centre of a cyclone is in Storm No. 42. The vessel in question, the name of which is unknown, had a westerly hard gale from noon to 3 P.M., when she suddenly ran into a calm, which lasted for one hour, during which torrential rain fell. She emerged from the calm into a north-north-west hurricane. This is the first occasion on which heavy rain is associated with the passage of the centre.

Storm No. 42.

Storm No. 44.

The next notice of a vessel being involved in the central calm area of a cyclone is given in Storm No. 44; when the *Inchulva* passed directly through the centre of a severe storm. From noon to 2 P.M. a north-easterly hurricane prevailed, but at the latter hour the wind fell, and the ship was in the calm centre of the cyclone. Numerous land birds and butterflies flew about the ship; a fearful boiling sea

prevailed. At 2-40 P.M. a light south-west wind sprang up, which increased in a few minutes to hurricane force. We have again to notice that the vessel entered and left the calm centre with opposing winds. In this case, however, the south-westerly hurricane did not appear perfectly suddenly, there having been a few minutes during which the wind was light.

Cyclonic phenomena of storms:—Passage of central area. *Storm No. 44.*

The next notices of ships passing through the calm centre of a cyclone are found under Storm No. 51. The *Albany* entered the storm centre at noon, and experienced a dead calm for 15 minutes. Apparently the wind was from north when she passed into the calm area, and at the end of the 15 minutes it burst out with hurricane fury from south. The wind in this case gradually decreased to a calm and gradually increased to a hurricane again. Numerous birds and insects flew about the ship. The *Clan Graham* passed into the same centre on the same day, but does not state how long she was involved in the calm area, but mention is made of torrents of rain falling.

Storm No. 51.

From these extracts it would appear:—first, that the gales immediately around the centre—no matter what the direction—are of intense to indescribable fury, but that directly the centre is reached the force decreases, and that the change from a wind of hurricane force to the calm characteristic of the centre of a cyclone is completed in the course of a few minutes, and that the reverse takes place as the ship emerges from the calm centre; and, secondly, that in the case of sailing vessels the ship, for some reason, passes directly across the centre, so that the entering and departing wind directions are almost invariably directly opposed to each other. In the case of steamers using their engines during the period they are involved in the calm the wind at exit depends on the course they have steamed relatively to the motion of the cyclonic system. Thus, the *Hindustan*, which entered the calm area with an easterly gale, left it with a southerly gale, while on the contrary—

Summary.

The *Lady Faversham*	entered with a	N.	passed out with a	S.	gale.
„ *Whitby*	„	„ N.-N.-E	„	S.-W.	„
„ *A. Metcalfe*	„	„ N.	„	S.	„
„ *Buckinghamshire*	„	E.-S.-E.	„	W.-N.-W	„

It appears, therefore, that a ship, dependent for its movements on the forces at work within the central area of a cyclone, will pass directly across the centre, and emerge with a wind direction exactly the reverse of that with which she entered. It is also important to notice that during the process of emerging, there occurs a period lasting for a few minutes, during which a light wind blows, and this wind, in all the cases investigated, had the same direction as the gale which has subsequently struck the ship.

As regards the extent of the calm central area it is practically impossible to form any estimation from the records of ships. Piddington has, from a comparison between the rate of motion of the storm, and

Extent of centre.

Cyclonic phenomena of storms:—Extent of centre.

the period during which a ship has been involved in the centre, attempted to form an approximation as to the size of these central areas. The attempt has not, however, been very successful, as he mentions one instance, in the Bay of Bengal, on which occasion a ship called the *Caledonia* was involved in the calm centre of a cyclone from 11 A.M. to 6 P.M., or during seven hours. There is, then, no available information which would give any accurate idea of the average extent of these calm centres, and it is impossible to form any opinion as to the length of time during which a ship, which may be unfortunate enough to enter the calm area, may be involved before making her exit on the opposite side. The following are the times quoted in the preceding pages:—

The *Lady Eversham*	occupied	15	minutes.
„ *Whitby*	„	90	„
„ *Ann Metcalfe*	„	30	„
„ *Hindustan*	„	60	„
„ *Buckinghamshire*	„	120	„
„ (No name)	„	60	„
„ *Inchulva*	„	40	„
„ *Albany*	„	15	„

These figures show that the time occupied in passing through the various calm centres, varied from 15 minutes to 120 minutes, and apparently might be extended to hours, if the record of the *Caledonia* mentioned above be accepted.

Sea within the centre.

In three instances it is mentioned in the log books that the sea within the centre of the cyclone was dangerously high. The *Lady Eversham* experienced a frightful sea; the *Typhoon* had the sea rising in crested masses, and the log of the *Inchulva* mentions a fearful boiling sea. On the contrary, the other vessels mentioned above give no particular importance to the sea prevailing within the centre, and the log of the *Buckinghamshire* says, "During the calm got the whole of the wreck cut clear away . . . 4 P.M., the hurricane commenced with equal violence, and the ship became again involved in sea." From these extracts it would appear that the amount of sea on within the centre was not so great as to impede work, and that outside the centre the agitation was much greater than inside.

With conflicting evidence of this character it becomes impossible to decide definitely as to the state of the sea within the central calm, and the point must be left to be cleared up by future observation.

Torrential rain is reported as falling within the centre by one ship, and the *Clan Graham* mentions the same fact, though it is not quite clear from her log whether the rain occurred within, or immediately outside, the calm area.

In the other instances quoted there is no mention of rain within the centre, and the log of the *Bolton* says that, as the ship was entering

the calm centre of the cyclone "severe squalls, torrential rain, then calms" were experienced.

Cyclonic phenomena of storms:—

Extent of the storm area.

The next point in importance is the extent of the storm area; that is to say, the extent of the surface over which the cyclonic influence is felt, even though the winds may not actually attain the force of a gale. A careful comparison of the weather experienced at different distances from the storm centre will disclose a marked difference in this extent when the cyclone is out in the open sea, and when it is approaching land. When out in the open sea the cyclonic influence, as disclosed by squally winds, rain and threatening weather, is felt as far as three, four, or even seven or eight hundred miles away from the centre; but when close to land, a ship, even at one hundred miles from a severe cyclone, may have but little indication of the neighbourhood of the meteor. The ports on the west coast of India afford striking examples of this characteristic. These stations, even when a severe cyclone is passing up the coast, experience hardly any stormy weather, though the winds usually shift to cyclonic directions. A still more striking example of this land influence is afforded by the weather in the Gulf of Aden on the occasion of the Aden cyclone. The *City of Venice*, which, on the 1st June, was in Lat. 13°40′ N. and Longitude 51° 30′ E., just at the entrance of the Gulf, and apparently only 87 miles from the centre of an exceptionally severe cyclone, which was advancing directly towards her, had only fresh northerly winds, and practically no other indication of the cyclone. On the following day, June 2nd, when the cyclone had just passed Cape Guardafui, similar evidence is afforded by the logs of vessels entering the Gulf from the Red Sea. The *Cuba*, only 12 hours before she was involved in the cyclone, recorded nothing more than light breezes, and the north-east gale of the advancing cyclone struck her quite suddenly. The *Columbian*, on the 3rd, recorded a similar experience. At noon the log states there was a squally appearance in the south-east, and at 2 P.M. heavy rollers were observed travelling from the same direction towards the vessel, but there was nothing particularly noticeable about the weather till 2-30 P.M., when a north-east hurricane struck the ship and she was involved in the cyclone. All the vessels at this time, and in this neighbourhood, record similar experiences, and the examples of the suddenness with which conditions change from merely unsettled squally weather to cyclonic weather of the most pronounced type are plentifully scattered through the preceding pages.

Storm No. 47.

Barometric indications.

In this connection may also be mentioned the very small notice of the central hurricane area which is ordinarily afforded by the changes of the barometer. The records of the Colaba Observatory, during the gale of the 1st and 2nd November 1854, give an excellent example of the comparative slowness of the barometric descent until the centre

Cyclonic phenomena of storms:—Barometric indications. *Storm No. 25.*

of the cyclone is close to the place of observation. The storm was at its worst over Bombay at 4 to 6 A.M., on the 2nd November, and the following are the barometer readings taken before and during the storm at Bombay:—

		Bar. Ins.	Diff. in 24 hours.
October 29th . . .	10 P.M.	29·763	—
„ 30th . . .	4 A.M.	29·704	—
	10 A.M.	29·776	—
	4 P.M.	29·642	—
	10 P.M.	29·741	−0·022″
„ 31st . . .	4 A.M.	29·675	−0·029″
	10 A.M.	29·776	0·000″
	4 P.M.	29.669	+0·027″
	10 P.M.	29·792	+0·051″
November 1st . . .	4 A.M.	29·714	+0·039″
	10 A.M.	29·797	+0·021″
	4 P.M.	29·622	−0·047″
	10 P.M.	29·607	−0·185″
„ 2nd . . .	4 A.M.	29·183	−0·531″

These figures show that twelve hours before the worst of the cyclone the barometer afforded very little indication of the approach of the storm, and it was not until 10 P.M. on the 1st that the indications were unmistakable. In the gale of November 19th to 23rd 1862 there are very few barometric readings given, but what observations are quoted appear to confirm the statement of the steadiness of the barometer prior to the approach of the actual centre of the cyclone. Thus, the barometer on the *Cecrops*, which, on the 21st November, lay in Latitude 17° 23′N. and Longitude 68° 27′E., stood at noon at 29·90″, and at 3 P.M. at 28·10″. It can hardly be assumed that the barometer had fallen much before the reading of 29·90″ at noon, so that it must be supposed that a ship may come into the immediate neighbourhood of a cyclone, which, in three hours, will occasion a fall of 1·80″ of her barometer without receiving any unmistakable preliminary warning. In the gale of May and June 1881 the *Inchulva* passed through a severe cyclone, and experienced a pressure of only 27° 15″ at 2 P.M. on the 29th May. For the hours before 2 P.M. on this day there are no barometer readings quoted, but for the 28th the following observations were recorded:—

Storm No. 32.

Storm No. 44.

	Ins.
May 28th, noon	29·694
„ 8 P.M.	29·674
„ midnight	29·694

This record shows that up to midnight on the 28th the barometer, though low, was steady. At 9 A.M. the log book says the first indications of a cyclone are given by the weather, and at 10 A.M. the barometer falls fast. Consequently, the ship was within four hours of entering the central area within which there was a pressure of only 27·15″ before the barometer began to fall quickly.

Cyclonic phenomena of storms:—Barometric indications.

Numerous other examples of this very gradual barometric fall until the centre of the cyclone is approached, and its sudden fall thereafter are to be found in nearly all the gales described in the preceding pages. This absence of barometric notice of the approach of a centre is unquestionably of importance to navigators, but it is to a great extent compensated for by the steadiness which, under ordinary conditions of weather, characterises the barometric record over the Arabian Sea. This steadiness is so great that it may be laid down as a law on which the utmost reliance may be placed that a fall of the barometer to 0·250″ below the normal pressure of the time of year is an unfailing evidence of the existence or formation of a cyclone over the Arabian Sea. With this information before him a navigator's first duty should be when his barometer gives him notice that the pressure has fallen to one quarter of an inch below the normal height of the season, to so manœuvre his vessel that all chance of running into the centre of a cyclone should be impossible. As scientific knowledge of the law of storms advances, this manœuvering will be more and more successfully accomplished, and the danger due to the want of barometric warning afforded by the approach of the central area of a cyclone, will be reduced to a minimum. In order to take advantage of this law, however, it is absolutely necessary that navigating officers should know the errors of their own barometers, as well as the average pressure over the region they are traversing. Yet, it is the exception rather than the rule for navigating officers to make an effort to obtain a really complete and trustworthy correction for their barometers. An incorrect barometer may, under certain circumstances, be almost as misleading as an incorrect chronometer, yet while time-balls are dropped at most of the principal ports to correct the rating of chronometers, there is, so far as the writer is aware, nothing whatever attempted at the ports in Western India to enable the sailor to obtain a trustworthy correction for his barometer, and apparently there is very little desire on the part of the sailing community for the correction. By flag signals the actual barometer reading at noon might be displayed on port semaphore towers, as easily as the time signal is given, and the officer rating the chronometer might at the same time and with equal facility correct the barometer of his ship.

PART II.

THE MONTHLY DISTRIBUTION OF STORMS IN THE ARABIAN SEA—AVERAGE TRACTS IN THE DIFFERENT MONTHS—RULES FOR FINDING THE DIRECTION OF THE CENTRE OF A CYCLONE—CONCLUSIONS DRAWN FROM THE PRECEDING INVESTIGATION.

Monthly distribution of storms.

Distribution of cyclones according to season.

Having discussed all the more important storms of the Arabian Sea in their chronological order, and having given all the available information regarding them, or quoted the authorities who have discussed them in greater detail, it is now necessary to reduce the information thus collected into a form which will render it practically useful, alike to the meteorologist and to the seaman. The first step in this direction is to gather the storms together under the heading of different months so as to determine the liability to disturbance of different periods of the year. Two determinations of this point already exist, the first being that of Dr. Buist, the second that of Mr. F. Chambers. Expressed as a percentage of the total number of gales discussed, the following are the determinations:—

Estimates already existing.

DR. BUIST.

Dr. Buist's list.

Jan.	Feb.	Mar.	Apl	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
4·4	0	0	21·7	17·4	13·0	4·4	0	4·4	8·7	21·7	4·3

MR. F. CHAMBERS.

Mr. F. Chambers' list.

Jan.	Feb.	Mar.	Apl.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
5·4	4·1	2·7	12·2	17·5	27·0	2·7	2·7	4·1	5·4	13·5	2·7

The latter list was amended by Mr. Blanford, and the amended distribution was apparently considered to be more correct than the original, partly because it accords much more nearly with the list of Bay of Bengal storms given in Mr. Blanford's *Vade Mecum*. Considering, however, the essential meteorological differences which exist between the Bay and the Arabian Sea, it is difficult to see how the correctness of one list as compared with another can be satisfactorily estimated in this manner. In the list now prepared several storms included by Mr. Chambers have been omitted, because only the more serious or dangerous cyclones have been discussed, and instances of strong winds at one station only have been neglected. Thus corrected, the monthly distribution becomes—

Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
5·7	0	3·8	13·2	18·9	20·7	1·9	0	1·9	11·3	20·7	1·9	Percentage.
3	0	2	7	10	11	1	0	1	6	11	1	(Actual number of cyclones).*

Author's list.

These figures show that there exists a slight tendency to the formation of cyclones in the Arabian Sea during January, but that this

* This differs from number in list, as cyclone 35 cannot be placed under any month.

tendency disappears in February, during which month there is no record of an important gale. In April cyclones commence, and the liability to storms steadily increases during May, and reaches its maximum in June. With the complete setting in of the south-west monsoon this liability practically ceases again, and only two storms have been recorded during July, August and September. In October the number of cyclones again increases, and the autumnal maximum, which occurs in November, is as great as that of June. In December only one gale has occurred. The following table shows the three determinations side by side:—

Distribution of cyclones according to season.

List.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	%	%	%	%	%	%	%	%	%	%	%	%
Dr. Buist . .	4·4	0	0	21·7	17·4	13·0	4·4	0	4·4	8·7	21·7	4·3
Mr. Chambers' No. 1.	5·4	4·1	2·7	12·2	17·5	27·0	2·7	2·7	4·1	5·4	13·5	2·7
Mr. Chambers' No. 2.	3·3	0	1·6	14·7	19·7	27·9	0	1·6	4·9	6·6	16·4	3·3
Present list .	5·7	0	3·8	13·2	18·9	20·7	1·9	0	1·9	11·3	20·7	1·9

Variations in the different lists.

In all the Arabian Sea lists there are certain points of resemblance in the determinations. All exhibit two maxima and two minima, and in all the lists the second maximum occurs in November. In Dr. Buist's list the vernal maximum occurs in April, while in the other three determinations the first maximum is in June. In Dr. Buist's list and the author's the vernal and autumnal maxima are exactly equal, while in Mr. Chambers' lists (Nos. 1 and 2) the earlier maximum is the maximum of the year. Considering still more closely the distribution during the year by the light of the foregoing descriptions of the different gales, it appears that still further modifications are possible. During January, according to Mr. Chambers' original list there occur four gales, according to his revised list two gales, and according to the author's list three gales. In 1805, on January 7th, there is a notice of a hurricane at Tellicherry, but of this there is no other information; in January 1863 an extract from the log books recently discussed to obtain the averages of the meteorological elements over the Arabian Sea, shows that one ship in Lat. 22° to 23°N., and Long. 60° 30'E. had a gale for four days, and on the 15th of January 1871 there is a record of a cyclone off Ratnagiri, but no other information. It is hardly possible to attach much importance to these vague notices of storms. It is certain that in the case of the more recent storms, *viz.* those in 1863 and 1871, there would have been fuller details obtainable had the storms been of a severe type. In all probability the storms at Tellicherry and Ratnagiri were

Distribution of cyclones according to season.

merely local squalls, and the four days' gale in Lat. 23°N. and Long. 60° 30'E. was one of those land-formed storms which at times descend from Southern Arabia, the Persian Gulf or the Mekran coast, into the north of the Arabian Sea. In February there are no cyclones. In March two gales are reported, one in the extreme north and one in the extreme south. Of the latter (March 1853) it is more or less doubtful if it was felt in the Arabian Sea at all, and the former was probably due to the occurrence late in the season (March 1874) of one of the storms noticed above. This disturbance apparently travelled from the entrance to the Persian Gulf towards the Cutch coast, and lasted two days.

First quarter very quiet.

From this it will be seen that during the first quarter of the year, except for a species of Nor'wester, which is occasionally felt in the extreme north, the weather over the Arabian Sea is very quiet.

In middle of April cyclone season commences.

May cyclones.

After the middle of April the cyclone season commences, and seven well-authenticated storms have occurred during this month. In May the number of cyclones rises to ten, nearly all of which were real and severe storms. The records relating to the earlier disturbances are very meagre indeed, but the fact of any notice at all existing after an interval of 200 years may probably be accepted as an indication of the severity of the storms. Storm No. 29, which occurred between May 15th and 20th, 1858, should in all likelihood not be included in this list. Gales were experienced at Bombay on the 15th, and at Cochin on the 15th and 20th, and a cyclone was reported in the Bay of Bengal (Lat. 17° 20'N. and Long. 91° 10'E.) on the 19th, and at Dacca on the 20th. It would be, however, impossible to connect these two occurrences, so that, though a gale *may* have swept up the west coast, it is obvious that it can have had no connection with a cyclone travelling northward in the Bay. With this exception all the storms recorded seem to have been undoubted cyclones. In June the number of cyclones rises to eleven. Of those which occurred early in the century there is very little information, but they all appear to be well authenticated. Only one cyclone is reported during July, and this must be regarded as a very exceptional phenomenon. The storm originated in the north of the Bay, passed across the head of the Peninsula, and entered the Arabian Sea off the Cutch coast on the evening of the 3rd July 1883; and subsequently travelled westward as far as Long. 63° 30'E. A path of this length is unusual, and it is seldom that the storms formed over the Bay at this season follow a course so nearly due west. Consequently, the occurrence of a cyclone in this month in the Arabian Sea may be regarded as a most unlikely contingency. In August there are no cyclones. In September, as in July, only one cyclone has up to the present date been recorded, and it is remarkable that the same coasts, *viz.* Cutch and Kattiawar, were affected as in the case of the July cyclone, rendering it perhaps a reasonable assumption that this also was a cyclone travelling

June cyclones.

July cyclones.

August and September cyclones.

abnormally westward from the north of the Bay. In October the number of storms rises to six, all of which appear to have been well-defined cyclones, of which three originated in the Arabian Sea itself, and three in the Bay of Bengal. November has eleven cyclones all well-defined and authenticated, and most of them severe. The early part of December may at times be affected by cyclones which have originated over the Bay during November, and have not been exhausted during the first days of December, but only one storm is reported which belongs wholly to the latter month. This storm occurred on the 17th December 1831, and was experienced off the Cutch coast. It was probably a severe example of that class of storms which, as previously noticed, affect this part of the Arabian Sea during the cold weather months.

Distribution of cyclones according to season. October cyclones. November cyclones.

December. cyclones.

This summary shows that there are five months of the year, *viz.* April, May, June, October and November, during which the Arabian Sea is liable to be disturbed by severe cyclonic storms, and seven months, *viz* Jannary, February, March, July, August, September and December, during which the occurrence of a cyclonic storm, other than severe gales or squalls chiefly from the north-west in the north of the Sea is an extremely rare phenomenon.

Summary of monthly distribution.

Geographical Distribution.

Having now discussed the distribution of the total number of storms with regard to the different months of the year, it is next necessary to consider whether any rule exists as to their geographical distribution with respect to season. The storms of the Arabian Sea are divisible into two classes, first, those which originate over that sea, and secondly, those which reach it from neighbouring regions. The latter class may be subdivided again into those coming across the Peninsula from the Bay of Bengal, and those which pass southward from Arabia, Persia and Mekran and give squally gales over the Sea to the north of Lat. 20°N. No well-defined instance of this last class of storms has been described. Storms Nos. 13, 33 and 41 are probably examples, but the available information as to their general characteristics is very slight. Commander Chapman, I.N., states that from December to March 1873-74 gales were reported on 46 days at Bahrein, generally from north or north-west. In Taylor's Sailing Directory, Part I, page 234, it is stated that along the south coast of Arabia, and across the entrance to the Persian Gulf to Mekran, strong land winds, called by the natives *Belat* or *Shemal*, may be expected from mid-December till mid-March. The wind commences to blow from north to north-north-west, and the gales last from one to three days, and at times even as long as seven days. Their approach is generally indicated by a faint, hazy arch over the land. Mr. Latimer Clark described, in a paper read before the Royal Meteorological Society, the winter gales experienced in the Persian Gulf during the laying of

Classes of storms in Arabian Sea.

Nor'westers in north of Arabian Sea.

Classes of storms in Arabian Sea :— Nor'westers in north of Arabian Sea.

the submarine cables. On one day, he says, "When 130 miles from Bushire, notice was received that a violent storm from north-west had passed Bushire, and was on its way down the Gulf. At 3-52 P.M. the storm burst forth with great suddenness and fury. Torrents of rain swept the deck, accompanied with continuous peals of thunder. After two hours the sky grew bright, and the wind changed into a gale from south-east, followed by a calm." It is plain from these descriptions that the storms in this region are small, or moderately small, local disturbances, arising from a disturbed condition of the atmosphere over the land, and that in the suddenness of their appearance they somewhat resemble the spring nor'westers of the Indian region. They probably vary considerably in size and intensity, and the gale (No. 13) experienced by the *Elphinstone*, 120 miles west of Dwarka on December 17th, 1831, was in all likelihood a severe example of this class of storm.

Southerly limit of cyclone formation.

Cyclones unknown over south-west of Arabian Sea.

As a general principle, it may be asserted that cyclonic storms are never formed over or near the Equator. As in the Bay of Bengal, Lat. 8° N. appears to be the boundary line to the south of which cyclonic storms are seldom or never generated. Also, so far as our present experience enables us to judge, cyclones are unknown to originate over the western half of the Arabian Sea, *i.e.* between Lat. 12°N. and the Equator, and Longs. 50°E. and 65°E. With these important exceptions, any part of the surface of the Arabian Sea may at different times in the year be the scene of the generation of a cyclone. Having stated these limitations, the next step in the study of the cyclonology of the Arabian Sea is the discussion of the tracks and places of origin of the cyclones in the different months.

Tracks and places of origin of cyclones in different months :— January.

January.—In 1805, on the 7th January, a hurricane occurred at Tellicherry, but beyond the mere statement of the fact there is no informatfon about the storm and there is nothing to show its further track, though the cyclone appears to have come across Ceylon, or the extreme south of the Indian Peninsula. The second gale was a storm off Muskat, in Lat. 22° to 23°N. and Long. 60° 30′ to 61°E. This was probably one of the land-formed winter gales noticed in the first part of this section. The third gale was in 1871, and the only record obtainable is that a cyclone occurred off Ratnagiri.

From these three instances the only safe deduction is that the Arabian Sea is singularly free from disturbances during this month, but that there exists a very slight liability to the appearance of cyclonic storms in about the latitude of Ceylon, and to the appearance of severe local gales or squalls on the extreme northern coasts.

February.

February.—There are no cyclones in this month, but the following extracts show that in the extreme north, squalls prevail, as in December and January :—"In February 1833 the East India Company's schooner *Shannon* was caught in a westerly gale off the mouth of the Indus. It lasted 12 hours, causing the destruction of about a dozen large native vessels. On February 3rd, 1857, the East Indian

Company's steamer *Ajdaha*, 70 miles to the south-west of Dwarka, had strong winds from south-west for 12 hours, shifting in a violent squall to north-east."

Tracks and places of origin of cyclones in different months :—

March.—There are notices of two gales during this month. The first on the 26th to 28th in 1853 is described as a furious hurricane all over Southern India. The principal damage occurred on the Coromandel coast, and there is no evidence obtainable that it was felt in the Arabian Sea.

March.

The second gale was a west-north-west to north-west gale in March 1874. The disturbance lasted for two days, and travelled from the Persian Gulf towards the Cutch coast. It was probably similar in character to, but perhaps more severe than, the squall described by Mr. Latimer Clark as occurring in the Gulf itself.

The remarks given under January apply with equal force to March. Under normal conditions the weather throughout the Arabian Sea, and during the whole month, is singularly quiet, but this quietness is liable in a long series of years to be disturbed; in the south by the appearance of a cyclone which has been developed at an exceptionally early date in the south of the Bay; in the north by the occurrence of an unusually late winter gale. Both these events may be regarded as most improbable, and, as a rule, the weather is as quiet as that in January and February.

Summary for March.

April.—During the first half of April the weather over the Arabian Sea is as undisturbed as during March, but after the 15th the liability to cyclones rapidly increases. During the years under discussion seven storms are noticed during this month, all of which occurred during the latter half of the month.

April.

The distribution of these seven storms over the surface of the Arabian Sea was irregular, rendering any generalisation as to the comparative liability of different regions very uncertain. Taking them in their chronological order, there is, first, the storm in 1779, about the middle of the month, which occurred near Anjengo and in which the ship *Cruiser* was lost. There is no other available information. Anjengo is a small place in Malabar in Lat. 8° 40′N., and it is probable that this storm was formed in the south of the Bay and crossed the extreme south of the Peninsula. The second storm in this month occurred on the 20th and 21st April 1782. It probably formed in the south of the Arabian Sea (about Lat. 9° North), and ran up the west coast of India. The centre passed northward to the west of the Gulf of Cambay, and the strong southerly gales on its east side caused a tremendous inundation around the Gulf. Several large ships foundered, or were cast on shore at Surat. The gale was felt on most parts of the west coast of India. The next storm in April was similar to the one just described. It apparently originated in the Arabian Sea as far south as Lat. 7° 30′N., and travelled up the west coast at no great distance from land. It passed the latitude of Bombay on the 19th,

Storm No. 3.

Storm No. 4.

Storm No. 19.

Tracks and places of origin of cyclones in different months:—

April—

Storm No. 20. and two days later a cyclone doing much damage to the shipping was felt at Muskat. There can be little doubt that the Muskat cyclone was a continuation of that of Malabar. Of the next storm, *viz.* that of April 23rd, 1848, the only notice obtainable is that a hurricane occurred off Ceylon. As this cyclone is included in Mr. Eliot's list as a Bay of Bengal storm, it is evident that a doubt exists as to which side of the island the storm belongs to, and it may be dismissed without further

Storm No. 27. comment. The fifth storm happened in the neighbourhood of the Kooria Mooria Islands from the 18th to 20th April 1856. This cyclone seems to have been a large and important one, and to have affected the track of steamers between Aden and Bombay. The East India Company's steamers the *Queen* and the *Malta*, on their passage from Aden to Bombay fell in with the cyclone and were nearly lost. It is impossible to say what was the path or area of the cyclone. In

Storm No. 30. April 1859, between the 21st and 28th, a cyclone crossed the extreme south of the Peninsula. It left the west coast, apparently at about mid-night on the 27th, as a large and important cyclone. After leaving the west coast there is no further information of the storm, but a very severe cyclone commenced at Aden at mid-night on the 30th, and lasted into the 1st of May. It has been suggested that this may have been a continuation of the Indian cyclone, but it implies an almost incredible velocity for the storm.

Storm No. 34. The next storm occurred on April the 29th, 1864, between Socotra and Aden.

Summary for April. Briefly, this account shows that after the 15th of April almost any part of the Arabian Sea except the south-west, may be visited by a cyclonic storm. Those storms which form over the Arabian Sea itself either originate in the extreme south-east, off Ceylon or the Malabar coast, and travel north-north-westward up the west coast and thence north-westward across the head of the Arabian Sea to the entrance to the Persian Gulf, or they originate over that portion of the sea enclosed by the African coast, Socotra and the Arabian coast. Those storms which arrive from the Bay cross in the extreme south, and take a west-north-west course across the sea.

May. *May.*—There are 10 cyclones recorded in May. Of Nos. 1, 2, 5, 12, 21, 29 and 38 there is practically nothing known, while Nos. 42, 44 and 49 are fully described in the text. The storms appear to be of two simple classes, the main characteristics of both, when once established over the Arabian Sea, being the same. The larger and severer cyclones of the Bay occasionally cross the Peninsula during the month, and are experienced on the west coast. Of this class are storms Nos. 12, 21 and 42, and not improbably Nos. 1, 2 and 5. These cyclones either break up in the neighbourhood of the west coast of India or, what is more likely, curve to the northward and travel up that coast. The storms of the second class originate over the Arabian Sea itself in the neighbourhood of the Laccadives or Maldives. When fully formed, they commence a northerly or north-north-

west movement, and travel in that direction to about the latitude of Bombay, when they move north-westward and pass across the head of the Arabian Sea to the Mekran coast. In one instance a storm (No. 49) was formed much further to the westward in about Long. 68°E. and Lat. 18°N. It also commenced with a northerly movement, and subsequently curved to north-west, and struck the Arabian coast. This was evidently an exceptional case, but it is interesting as showing that the movement, first to north, and then to north-west, is universal at this period of the year over the Arabian Sea.

Tracks and places of origin of cyclones in different months :—May.

Briefly, the investigation shows that cyclones are fairly numerous over the Arabian Sea during May, that they may occur at any period during the month, and that they are generally severe. They are ordinarily first met with near the west coast of the Peninsula, and they travel northward up that coast as far as the latitude of Bombay, when they commence a north-westerly movement, and move up towards the head of the Arabian Sea and the Mekran coast. In addition to this, the investigation shows that, as a very exceptional circumstance, a storm may form out to sea as far west as Long. 68°E., but in that case also the future path of the storm is similar in direction to the tracks of those which form further to the eastward, *viz.* first to north, and subsequently to north-west.

Summary for May.

June.—Eleven cyclones are credited to the month of June. Of the majority of these, *viz.* Nos. 9, 10, 14, 15, 31, 36 and 39, there is nothing but the vaguest information available. Of the other four the tracks are laid down on the charts, and the information is full and detailed. Of No. 9 all that is known is that a furious hurricane prevailed off Mangalore. There is no indication of its having crossed the Peninsula, so that it may be assumed to have formed over the Arabian Sea off the west coast. No. 10 was met with in Lat. 16°N. and Long. 70°E. The cyclone was travelling from S. S.-E. to N. N.-W. and was a very severe storm. The H. C. ship *Essex* was involved in it. No. 14 was encountered in Lat. 23°N. and Long. 63° to 65°E. The track of this cyclone is very doubtful, and rests on the evidence of one ship only, *viz.* the H. C. ship *Ternante*. This ship passed through the centre, and the storm was apparently travelling from E.-S.-E. to W. N.-W. towards the Persian Gulf. If this were really the track of the storm, the cyclone may have originated off the west coast of the Peninsula, and moved north-westward and finally west-north-westward, or it may have been an exceptionally early formed storm in the Bay, which had traversed the head of the Peninsula, and passed out into the Arabian Sea across the Cutch coast. For No. 15 the following is the only information available. A tremendous hurricane swept over Bombay, causing an immense destruction of property and loss of shipping. This was probably a cyclone travelling up the west coast, and not unlikely preceding the first burst of the monsoon. No. 31 was a severe cyclone, with tremendous winds and a calm centre. As far as can be judged from the record of the single

June.

Tracks and places of origin of cyclones in different months :—June.

ship involved (the *Typhoon*), the storm was travelling from the eastward to the westward, or perhaps even from the north of east to the south of west. No. 38 was in all probability only an exceptionally strong burst of the monsoon. No. 39 was apparently an example of a cyclone formed off the Arabian coast, and travelling west-south-westward towards the Gulf of Aden. It was first met with in Lat. 16°N. and Long. 59° E. and subsequently immediately to the north of Socotra. No. 47 was the widely known Aden cyclone. It originated in Long. 61° or 62° E. and Lat. 12° to 14° N., and moved first to west and subsequently to west-south-west into the Gulf of Aden. No. 48 was a cyclone which formed immediately after the Aden cyclone, in Lat. 15° N. and Long. 71° E., and travelled first northward, and subsequently north-westward, to the Arabian coast, which it struck in Lat. 21° N. and Long. 58° E. No. 51 was a cyclone which formed in advance of the monsoon. It commenced in Lat. 17° N. and Long. 72° E., and on becoming fully developed moved west-north-westward, striking the South Arabian coast at about Cape Madrak, north of the Kooria Mooria Islands. The last cyclone, No. 54, was also formed in front of the advancing monsoon. It commenced in Lat. 13° 30′ N. and Long. 68° E., and moved almost due northward, disappearing on the Cutch or Kattiawar coast.

Summary for June.

This account shows that any portion of the Arabian Sea north of Lat. 12° N. is liable to be visited by cyclones during June. Excluding the last cyclone on the list, the behaviour of which was exceptional, the storms show well-defined courses varying with their place of origin. In the majority of instances the cyclones of this month are formed in front of the advancing south-westerly monsoon current in about Long. 70° E. They occasionally commence as far south as Lat. 13° N., in which case they travel northward as far as Lat. 18° N., after which they curve to north-west, and so pass on to the South Arabian coast. When, on the other hand, the storms have formed in about Lat. 17° or 18° N., and have *not* advanced to that position, no northerly movement is developed; but, as soon as each storm is fully formed, it begins at once to move north-westward or west-north-westward. This west-north-westerly track leads the storms just to the north of the Kooria Mooria Islands. When cyclones are formed to the west of Long. 65° E. no northerly movement is developed, and the track of the cyclone is directed towards the Gulf of Aden. Two examples of this movement are given—one being storm No. 39, the other storm No. 47. The last storm on the list, No. 54, followed an exceptional course, in that it continued its northerly movement from Lat. 13° 30′ N. to Lat. 21° 30′ N. without developing any great westerly inclination.

Cyclones formed in centre of Arabian Sea.

July.

July.—Only one cyclone is reported. This storm advanced from the Bay across the head of the Peninsula and passed out across the Cutch coast into the north of the Arabian Sea, over which it travelled west-north-westward as far as Long. 63° E.

August.—No cyclones.

Tracks and places of origin of cyclones in different months:—August and September.

September.—Storm No. 11 is the only example of a cyclone in this month. It occurred on the 25th of September 1819 in Cutch and Kattiawar, and there are no particulars as to its direction or rate of motion. Its track was probably from south-east to north-west.

October.

October.—For this month there are records of six cyclones, of which three came from the Bay of Bengal. No. 16 was formed over the Bay on October 22nd, 1842, and reached the west coast near Calicut on the 25th. From this point it travelled nearly due westward, the last distinct trace of it being in Lat. 12° 30′ N. and Long. 59° E. on November 1st, though there are reasons for believing that it advanced as a diffused disturbance into the Gulf of Aden. No. 46 also advanced from the Bay westward to Calicut, where it coalesced with a large diffused disturbance over the Arabian Sea. The last cyclone entering the Arabian Sea from the Bay was No. 52. This storm appeared to cross the west coast near Goa, passed along the west coast, close inland, to nearly the latitude of Bombay, after which it recrossed the coast on a north-easterly course, and passed into Khandeish. Of the other three storms little is known. No. 24 was a hurricane to the southward of Ceylon. No. 26 was a cyclone off the south coast of Arabia, which travelled south-westward from Lat. 17° N. and Long. 58° E. to Lat. 14° N. and Long. 55° 30′ E., and No. 40 was a cyclone somewhere between Socotra and Bombay.

Summary for October.

Most of the larger cyclones of this month are apparently continuations of the severe cyclones which form over the Bay at this season, and advance in a westerly direction across the Peninsula. The most southerly one, No. 16 (1842), continued this westerly advance after it had passed the Ghauts, but the more northerly storms curve to the northward, and advance with much diminished vigour up the west coast as far as Bombay, where they recurve and proceed to north-east.

November.

November.—Eleven instances of cyclones are reported in November, all but one (No. 53) of which either originated near the west coast, or crossed that coast from the Bay. Of these cyclones, Nos. 17, 18, 28(?), 43 and 50, or nearly half the whole number, crossed the Peninsula from the Bay. Nos. 6, 7, 25 and 32 were developed off the west coast in about Lat. 10° N., and travelled first to north-west, and then to north-east, to the north of the Arabian Sea. No. 22 was apparently formed and dissipated between Bombay and Karachi, and No. 53 was formed in Lat. 12° N. and Long. 68° E., whence it travelled northward, and north-north-eastward, to the Kattiawar coast.

Summary for November.

The storms of this month show well-marked characteristics. The storms which form over the Arabian Sea near the west coast, as well as those which come across the Peninsula, travel out to sea on a curved course, first to north-west or west-north-west, then to north,

Tracks and places of origin of cyclones in different months :— December.

and finally to north-east. Those storms which form out at sea at a considerable distance from the land, apparently follow a similar track. Examples of this course are shown in the storms Nos. 32 and 53.

December.—Two cyclones have occurred during December. The first storm was met with off the Cutch coast, and was advancing from north-west. The second, No. 17 (also included in the November list), originated at the end of November in the south of the Bay of Bengal, crossed Ceylon and Cape Comorin, and appeared over the Arabian Sea on December 3rd, 1845. The main disturbance advanced first to west-north-west, then to north-west, and finally to north, and broke up in Lat. 14° N. and Long. 71° E., but a secondary disturbance advanced more to the westward, and was met with in Lat. 13° N. and Long. 60° E.

Sumary for December.

These records show that in December a storm from the south of the Bay may advance into the south of the Arabian Sea, and that it then follows a course similar to that described by the November storms, *viz.* a curved course, first to west-north-west, then to north-west, and finally to north or north-east.

Latitude of origin of cyclones.

Year.—An inspection of the charts for the different months shows that the latitude of origin of cyclones undergoes a well-marked oscillation during the year. In April cyclones appear as far south as Latitude 7°30′ or 8° N.; by May the place of origin is removed northward to Latitude 12°30′ N.; by June to Latitude 13° to 18° N.; and in July the only cyclone recorded was in Latitude 23° N. In August and September there are no cyclones, but in October the region of origin of cyclones has retreated southward to between Latitudes 10° and 15° N., and by November and December it has still further retreated to between Latitudes 7°30′ N. and 12°30′ N. Another marked feature is, that the paths of most of the cyclones of the Arabian Sea appear to assume the form of parabolic curves, the concavity of which faces the west or south-west during the pre-monsoon period and the north-east or east-north-east in the post-monsoon period. This change appears to coincide with the annual appearance and disappearance of the S. W. monsoon.

Curve of motion.

General direction of motion.

During the whole of the cyclone season the main track of the larger cyclones formed over the Arabian Sea, subject to the change in the curvature noticed above, is very much the same. They nearly all originate somewhere off the west coast of the Peninsula, travel more or less to the northward, and subsequently curve to north-east or north-west, according to the season of the year.

Occasionally this general direction is departed from, and it is sometimes difficult to account for these divergencies. For instance, in the cyclone of June 1889 the northerly movement was much larger than is ordinarily the case, and it was not till quite close to the Kattiawar coast that the storm curved to the north-west. There is nothing observable in the pressure distribution at this period over the land area to the northward of the Arabian Sea, which would account for this abnormal northing.

Progressive motions of cyclones.

The principal controlling agents on the progressive movements of cyclones are:—

(1) The distribution of vapour in the region in which the cyclone exists;
(2) The distribution of pressure at the earth's surface;
(3) The geographical surroundings of the region over which the cyclone has formed and is advancing, and
(4) The general motion of the atmosphere in which the cyclone exists.

Distribution of vapour.

The principal source of vapour over the Arabian Sea is unquestionably the monsoon current from trans-equatorial regions. The countries surrounding the sea are all more or less dry, and any winds blowing out from them must have a low humidity: hence it may be accepted that the moisture which is drawn into, condensed in, and deposited by, the cyclones of the Arabian Sea, is brought up by the massive current of air crossing the Equator from the Southern Indian Ocean. From this it would appear that, if the distribution of vapour have any effect on the resultant movements of cyclones, the motion of Arabian Sea cyclones should be towards some southerly point, as the system would probably be drawn towards the region in which there is most vapour. That this is not the case is apparently due to the fact that in the western portions of the cyclone system, a northerly and probably descending wind, drawn from a dry region, prevails, and the moist winds of the south-west monsoon are thereby prevented from feeding directly into those sides of the cyclone system. On the S.-E., E., N.-E. and N. sides of the cyclone, on the contrary, the equatorial current of wind sweeps around and into the system without hindrance, ascensional movements take place, and with them the condensation of the aqueous vapour. Hence, though the source of this aqueous vapour lies to the S. and S.-W. of the cyclonic system, and the principal supply of moisture lies in the same direction, the cyclone moves to N. and N.-W., partly because the energy of the cyclones is derived from the aqueous vapour condensed, and it is over the northern portions of the cyclone that condensation takes place most freely. It is very probably partly to this cause that the cyclones formed off the Malabar coast have a slightly easterly component of motion in the first stages of their existence.

Distribution of pressure at earth's surface.

From a consideration of the charts of average pressure distribution, and the general course of the cyclones, it appears that at certain times of the year cyclones have a marked tendency to travel towards that neighbouring region on the earth's surface where the average pressure is relatively low. This advance is not made directly, but proceeds to a certain extent along the line of the isobars.

Geographical surroundings.

The cyclone records of the Bay of Bengal, as well as those of the winter storms of Upper India, show that, when once a cyclone of large dimensions and great vertical height has been formed, the obstacle formed by the presence of highlands in its line of advance is comparatively easily surmounted. The October and November cyclones of the Bay apparently pass directly across the highlands of the south of

Progressive motions of cyclones.

Geographical surroundings.

the Peninsula, and storms formed over the north of the Bay have been known to travel over many miles of country covered with broken ground of considerable elevation. But, though many cyclones exhibit this power of surmounting mountains and hills it is equally unquestionable that highlands, and particularly high precipitous sea coasts, often exercise a considerable influence on the progressive motion of cyclones. The storms of May and June in the Arabian Sea, which are carried directly towards the Arabian coast, are apparently broken up as soon as they reach that coast, while the cyclones of October and November, which curve round to N.-E. and E., and strike on the Konkan coast, appear also unable to surmount the escarpment of the Ghats. Thus, a coast line directly opposed to the line of advance of a cyclone has a disintegrating and destructive effect on the storm, though, with otherwise favourable surroundings, it does not necessarily follow that the whole cyclonic system is thereby destroyed. When a cyclone approaches a coast line not directly, but obliquely, the effect of the coast line is to divert the cyclone, so that its course approximately coincides with the trend of the coast line. A striking example of this is afforded by the track of the Aden cyclone. At first this storm advanced on a due west course, but as soon as the circumferential limits of the actual storm area touched the highlands of Southern Arabia, the line of advance shifted to southward, and the centre of the storm avoided the coast lines of Southern Arabia, and of Somali Land, and continued its sea track until its further course was directly obstructed by the western littoral of the Red Sea. The centre then crossed the coast. Hence it may be concluded that, except where a cyclone is advancing directly towards a coast line, the influence of the land will modify the course, so far as to produce a certain amount of agreement between the direction of advance of the cyclone and the general trend of the coast.

Summary of progressive movements.

The controlling influences above described result in the cyclones of the Arabian Sea adopting, as a general rule, the following tracks:—

During the pre-monsoon period, *i.e.* roughly from the middle of April to the beginning of June, cyclones are formed in the neighbourhood of the Laccadive or Maldive Islands, and pass from that position northward or north-north-westward along, but at a considerable distance from, the west coast of the Peninsula; on reaching the Latitude of 17° or 18°N. the line of advance shifts round towards north-west, and with that direction the cyclones pass on to the Arabian coast.

During the post-monsoon period, *i.e.* the period from the middle of October to the end of November, cyclones originate in about the same locality and travel, first to north-west, then to north, and finally to north-east and east. The earlier part of the course is directed towards the centre of the Arabian Sea, the latter part towards he Konkan, North Bombay or Kattiawar coasts.

The following table shows the resultant direction of motion and velocity for each day of existence of the various cyclones in the different months of the year :—

Resultant directions and rate of motion of cyclones.

Days after movement commenced.	Jan.		Feb.		Mar.		April.		May.		June.		July.		Aug.		Sep.		October.		November.		December.	
	Direction of motion.	Miles in 24 hours.	Direction of motion.	Miles in 24 hours.	Direction of motion.	Miles in 24 hours.	Direction of motion.	Miles in 24 hours.	Direction of motion.	Miles in 24 hours.	Direction of motion.	Miles in 24 hours.	Direction of motion	Miles in 24 hours.	Direction of motion.	Miles in 24 hours.	Direction of motion.	Miles in 24 hours.	Direction of motion.	Miles in 24 hours.	Direction of motion.	Miles in 24 hours.	Direction of motion.	Miles in 24 hours.
1st	...	...	...	...	...	...	N. by W.	65	N. 17° E.	169	N. 49° W.	97	W.	308	...	...	...	...	W.	283	N. 59°W.	225	N. 79°W.	363
2nd	...	...	...	...	...	...	N. by W.	65	N. 6° W.	210	N. 59°W.	154	N. 79° W.	259	...	...	...	...	N. 79°W.	305	N. 12°W.	192	N. 45°W.	109
3rd	...	...	...	...	...	...	N.-N.-W.	65	N. 28° W.	137	N. 71°W.	165	...	...	...	...	...	...	N. 79°W.	102	N. 18° E.	148	N. 45°W.	109
4th	...	...	...	...	...	...	N.-N.-W.	130	N. 34° W.	167	N. 77°W.	150	...	...	...	...	...	...	N. 79°W.	102	N. 42° E.	116	N. 11°W.	80
5th	...	...	...	...	...	...	N.-N.-W.	178	N. 68° W.	90	N. 49°W.	108	...	...	...	...	...	...	W.	102	N. 56° E.	360	...	...
6th	...	...	...	...	...	...	N.-N.-W.	275	N. 34° W.	100	N. 62°W.	186	...	...	...	...	...	...	W.	102	...	...	...	...
7th	...	...	...	...	...	...	W.-N.-W.	362	...	...	...	...	...	...	...	...	...	...	S. 79° W.	153	...	...	...	...
8th	...	...	...	...	...	...	W.-N.-W.	522	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
10th	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Resultant directions and rate of motion of cyclones

Taking the months of May and November as representative months for the two seasons of the year, *viz.* for the cyclone periods immediately antecedent to the setting in of the south-west and of the north-east monsoons, and treating the average results given in the above table by a harmonic formula, the following directions and motions are obtained :—

May.			November.		
1st day	N.17° E.	169 miles.	1st day	N. 59° W.	225 miles.
2nd „	N. 4° W.	164 „	2nd „	N. 23° W.	161 „
3rd „	N.21° W.	167 „	3rd „	N. 12° E.	141 „
4th „	N.39° W.	126 „	4th „	N. 45° E.	200 „
5th „	N.42° W.	115 „	5th „	N. 53° E.	239 „
6th „	N.50° W.	90 „	6th „	...	

Rate of movement.

The courses and distances have been laid down on the chart, Pl. LXIV, which shows very distinctly the movements characteristic of the two seasons. The cyclones in the pre-monsoon period move at first very slightly to the east of north, then towards north, and finally to north-west or even north-west by west. The rate of motion for the first three days after movement has been fairly established is approximately the same for each day, and equals about 7 miles per hour, but on the fourth day the rate decreases to $5\frac{1}{3}$ miles per hour, on the fifth day to $4\frac{3}{4}$ miles per hour, and on the sixth day to $3\frac{3}{4}$ miles per hour. On the whole, then, it may be taken for granted that the rate of motion of the cyclones of this period undergoes a diminution as the age of the cyclone increases; there is, however, one interesting fact shown by the table, *viz.* that a small but well-marked diminution in rate occurs when the cyclone is changing its direction from an easterly to a westerly component of motion.

The cyclones of the post-monsoon period travel first to north-west by west, then to north-north-west, then to north by east and finally to north-east by east. The rate of motion decreases during the first three days, reaching its minimum on the third day, after which the rate increases again. The following are the rates per hour: On the first day the rate equals $9\frac{1}{3}$ miles per hour; on the second day $6\frac{3}{4}$ miles per hour; on the third day $5\frac{1}{2}$ miles per hour; on the fourth day $8\frac{1}{3}$ miles per hour, and on the fifth day almost 10 miles per hour. These figures show a great diminution of velocity as the storm is moving north-westward and a minimum of velocity as the change from a westerly to an easterly component of motion takes place. When the recurving has been accomplished, and the system has commenced a north-easterly and easterly progression, the rate increases and reaches its maximum on the last day of the existence of the storm.

Comparison of the incurvature of winds in different octants of a cyclone.

As a result of a comparison of more than 300 observations between wind directions and the centres of cyclonic storms, the following table and the results shown graphically on page 117 have been compiled. The cases in which this comparison has been instituted have been carefully selected, and have only been accepted when the position of the centre was, for all practical purposes, unquestionable, and the surrounding winds were blowing freely and uninfluenced by neighbouring lands. All along the west coast of India from Cape Comorin to Cutch and Kattiawar, the wind directions were at times very abnormal, and any result which included these winds would have been simply the mean of widely varying relations, and would have had no practical value. Within the angle of the Arabian Sea formed by the Konkan, Cutch and Kattiawar coasts, this variability of the wind is particularly noticeable, the wind in this region being much more strongly easterly when a cyclone is passing to north-west outside this angle of the sea, than experience would have suggested. Omitting, then, winds recorded in these exceptional regions, the results show that—

With a	N. wind	the centre lies	S. 68° E.
„	N.-N.-E.	„	S. 42° E.
„	N.-E.	„	S. 33° E.
„	E.-N.-E.	„	S. 3° E.
„	E.	„	S. 11° W.
„	E.-S.-E.	„	S. 50° W.
„	S.-E.	„	S. 63° W.
„	S.-S.-W.	„	S. 85° W.
„	S.	„	N. 70° W.
„	S.-S.-W.	„	N. 39° W,
„	S.-W.	„	N. 30° W.
„	W.-S.-W.	„	N. 2° E.
„	W.	„	N. 27° E.
„	W.-N.-W.	„	N. 54° E.
„	N.-W.	„	N. 82° E.
„	N.-N.-W.	„	S. 84° E.

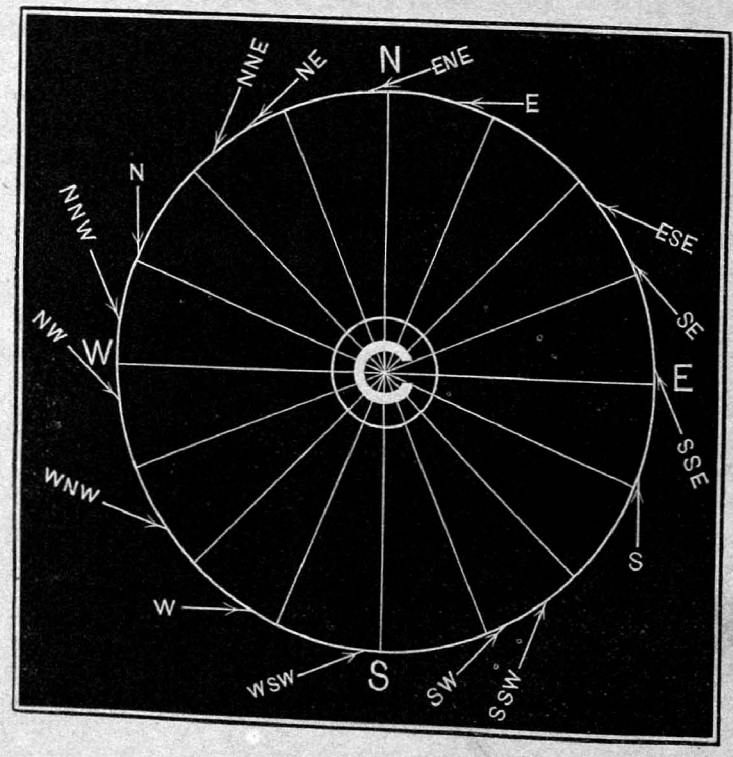
These relations show fairly regular variations, and are probably approximately correct, though that there are variations of considerable magnitude in the relation between the wind direction and the storm centre cannot be denied. A considerable portion of these variations is due to faulty observations, but it is probable that this source of error has been largely eliminated by founding the means on a large number of observations. Still, there is no doubt that in different cyclones there are individual differences, depending first, on the place of origin of the cyclone, and second on the time of the year in which it occurs, which are peculiar to the individual cyclone or to a particular class of cyclones. It will be seen from the figure given below that the amount of incurvature of the winds varies on the different sides of the cyclone centres, being greatest in the west and least in the east. In consequence it would be misleading to lay down for the Arabian Sea any such general law as that in any part of the cyclone the centre

The angle between the wind direction and centre of cyclone.

lies five points to the left hand, when the observer stands with his back to the wind. The following figures show the angle which the wind direction makes with the radius of the storm circle :—

With a	N.	wind the angle is	114° 50′
„	N.-N.-E.	„	109 20
„	N.-E.	„	108 30
„	E.-N.-E.	„	104 10
„	E.	„	109 20
„	E.-S.E.	„	108 50
„	S.-E.	„	111 0
„	S.-S.E.	„	108 30
„	S.	„	112 0
„	S.-S.-W.	„	111 10
„	S.-W.	„	112 40
„	W.-S.-W.	„	112 10
„	W.	„	117 40
„	W.-N.-W.	„	121 50
„	N.-W.	„	122 20
„	N.-N.-W.	„	119 10

From these figures it will be seen that there is a difference, in the bearing of the centre to the wind direction, of 18° 10′ between the east-north-east and north-west sides of the storm circle, and this difference must be borne in mind in estimating the probable position of the centre—



Classes of storms:—

Classes of storms.—The large cyclonic storms which affect the Arabian Sea are of two classes, *viz.* those which originate within the sea itself, and those which enter it from the Bay of Bengal across the Peninsula or Ceylon. Of both these classes of storms numerous instances have been quoted in the earlier part of this memoir, the proportion of indigenous to foreign storms being, so far as can be judged, as 3 is to 1. The fact that storms from the Bay thus crossed the Peninsula was recognised as long ago as 1843, when Piddington "showed satisfactorily that the storm (of October 22nd to November 2nd 1842 which he tracked for 900 miles across the Arabian Sea, was identically the same with that of Madras." Recent experience apparently shows that this passage of the Peninsula by storms is by no means an unusual occurrence, but a certain amount of doubt exists on the subject, and Mr. Blanford says, "It is extremely doubtful whether, in the majority of instances, perhaps in any case, a vortex formed over the Bay of Bengal ever really crosses the Peninsula."

Storms from the Bay.

The experience of the past few years has shown that, prior to the passage of a storm from the Peninsula into the sea to the westward, the antecedent conditions over the Arabian Sea have been disturbed, but this may indicate rather a favourable condition for the advance of the depression than that an entirely fresh depression is formed, and passes on in a direction similar to that previously followed by the disturbance crossing the Peninsula. It must be borne in mind, in discussing this advance, that on the western side of the Peninsula there is an almost uninterrupted range of hills of an average height of 3,000 feet, and with peaks in the south running up to between 5,500 feet and 7,000 feet. It is obvious that in crossing such a barrier no surface storm could be expected to re-appear, with precisely the same characteristics as regards size, intensity and shape as it possessed before it commenced to surmount the barrier, and it is rather remarkable that there should be, on the whole, any possibility of tracing the storm across, and to the west of the Ghats, than that there should be extensive changes in its character. It is probable that it is only storms which extend to an exceptional height into the upper atmosphere which surmount this obstacle.

Storm No. 44.

Mr. Chambers, in his account of the cyclone of the 25th of May to the 2nd of 1881 June in the Arabian Sea, estimates, from the occurrence of hail, that the height to which that disturbance extended could not have been less than 22,000 feet, and with such a vertical extent of disturbance it is probable that the Ghâts would easily be surmounted; but even accepting this estimate, it is still quite possible that in passing over an irregular mountain mass the storm circulation on the earth's surface would be so broken as to render the definition of the whole disturbance less distinct after than before the passage. The manner of the descent of the disturbance from the elevation at which

Storms crossing the Ghâts.

Weather along the strip of land intervening between the Ghâts and the sea.

it has crossed the Ghâts to the level of the sea, is at present involved in doubt. It is unquestionable that during the passage of a disturbance in this manner the force of the wind at the sea ports along the western base of the Ghâts is inconsiderable. In fact, it may be taken as generally true that any storm crossing the Peninsula into the Arabian Sea, no matter what its original or subsequent intensity, will have relatively little influence on the weather over the narrow strip of land intervening between the Ghâts and the Arabian Sea, or over the sea adjacent to the west coast of the Peninsula.

Classes of storms:—Storms from Bay crossing Ghâts.

Presuming then that cyclones actually cross the whole breadth of the Peninsula the only apparent conclusion is, that on the storm encountering the Ghâts the whole of the lower circulation is broken up, and that the descent subsequently effected is carried out slowly, not by the sudden and abrupt descent of the disturbance, but by a gradual downward extension of the cyclonic motion into the unaffected surface strata of air. Hence it is not till the cyclone has advanced to some distance from the coast line that the full effects of the phenomenon are experienced, and that the storm becomes fully recognisable.

Storm No. 16 is an example. The centre crossed the Madras coast as a severe storm at 5 P.M. on the 24th of October 1842. Its passage across the Peninsula was plotted off with considerable uncertainty, and there was nothing particularly striking in the weather at the west-coast ports. At Mangalore the wind direction shifted from north-west to south as the storm passed over, but the force was not high, and the weather was only showery. At Mahé (60 miles north of the estimated track) no person noticed any particularly bad weather, or such signs of it as might have indicated that a storm was raging elsewhere, and the Sub-Collector of Malabar, who was at Mount Dilly at the time, remarked that the sky looked very stormy, but that no gale was experienced. There can, however, be little doubt that a very severe storm passed across, or over the Malabar coast, and out into the Arabian Sea during the 25th October, and that the cyclone had descended to the sea-level by the 26th, when it was encountered by the *Futtay Salaam* in Latitude 10° 16′ N. and Longitude 68° 54′ E., and by many other vessels on the 27th and 28th.

Storm No. 17.

Three years later, in November 1845, a second storm was formed over the Bay of Bengal and passed across the Peninsula into the Arabian Sea. In this instance, however, the origin and track of the storm was much to the southward of the origin and track of the storm of 1842. The centre of the storm passed over the steam ship *Hindustan*, off the north-east coast of Ceylon at 1 A.M. on the 2nd, and at noon on the 2nd was over the Gulf of Manaar. After leaving the Gulf of Manaar the storm had to cross the flat land in the extreme south of the Peninsula, and Palamcottah had a violent gale from south-east at midnight on the 2nd. The storm had then to

cross the mountains between the British districts and the native state of Travancore, some of which rise to a height of 8,000 feet. Arguing from the experience of the former storm, it might have been anticipated that there would have been little indication of the cyclone in the registers of the coast observatories, but Trevandrum had a sudden violent gale at 1 P.M. of the 3rd, followed by a calm at 3-30 P.M. which in its turn was followed by another violent gale, while Cochin, Quilon and Cannanore all had more or less severe gales of wind, and the usual characteristics of the passage of a cyclone.

Classes of storms:—Cyclones crossing the Ghâts.

With regard to the question of the origin of cyclones, the observations discussed in the first part of this memoir give very little definite information.

Origin of cyclones:—

A detailed investigation into the interesting subject of the origin of cyclones in the Arabian Sea would be out of place in these pages, but the following facts are directly connected with the first appearance of cyclones and should prove of service to the sailing community. In the first place, except on one occasion, the observations discussed afford no instance of long continued calms preceding the appearance of a cyclonic storm, while on the contrary there are several notices of the sudden appearance of cyclones. Thus, Dr. Buist, speaking of the Bombay cyclone of November 1854, describes it as a great circular revolving disk of air, which made its appearance *suddenly* on the afternoon of the 1st, with a perfectly well-defined boundary. The *extreme* suddenness may probably be attributed to want of earlier information, as there is nothing in the preceding observations to lead to the idea that an already well-defined cyclone has ever appeared without some preliminary period of warning, though there is equally no evidence of any long period of calm incubation. In the second place attention must be drawn to the abnormal northerly wind and fine weather, which, as pointed out in the earlier part of this memoir so frequently characterise the period immediately antecedent to the appearance of a cyclone. The Aden cyclone, the immediately succeeding cyclone, and the storm of November 1888, were all marked by antecedent strong northerly winds, and not by antecedent calms and light variable airs. Hence, the writer is of opinion that in the Arabian Sea an abnormal northerly wind over the centre or south of the sea is an almost certain indication of a cyclone in the pre-monsoon period, and that an abnormal strengthening of the existing northerly wind in the centre and north, or of the southerly wind in the south of the sea in the post-monsoon period, is an indication of a cyclone in that period, and that long periods of calm incubation do not occur over the sea on the western side of the Indian Peninsula.

Reference—See page 90.

Storm No. 25.

Storm No. 47.
„ „ 48
„ „ 53

There is another point which the present investigation emphasises, *viz.* the absence of all important movement within the calm centre of the cyclone at the level of the sea. In several of the cases quoted, where ships have found themselves involved in the calm centre of a

Calm centre of cyclone. Presence of birds, butterflies, and insects.

Absence of movement at centre.

large cyclone, their decks have been covered with land and aquatic birds, and numerous butterflies and insects have flown about the rigging. In these instances the cyclone has been met with at a very considerable distance from land, and it is inconceivable that such light objects as butterflies, insects and small birds could remain for any long period within a column of air which had any large ascensional or descensional movement. That there should be no gyratory movements at the centre of a cyclone agrees with theoretical deductions, but it has been popularly supposed that both in the case of water-spouts, and of cyclones, the central calm area is formed of a column of air in rapid ascent. On the other hand, certain recent writers have suggested, from the humidity changes observed during the passage of the calm centre, that the column is really the seat of a descensional current. The presence of insects and butterflies seems to negative both these suppositions, and apparently leads to the conclusion that within the calm centre, at the level of the sea, there is practically no motion either upward or downward. Indirectly, also, the presence of insects and such frail objects as butterflies within the centre, seems also to contradict any idea that in the superior parts of the central column there is much ascensional movement, as this could hardly occur without rain, and with rain and without shelter no butterfly could exist for any length of time. In one instance torrential rain is reported from a ship within the centre of a cyclone, and in this case no mention is made of birds or insects, but in the other instances quoted the inference is that rain ceased when the centre was reached, and the presence of insects seems to confirm this inference.

Absence of rain over centre.

Summary of conclusions.

Briefly, the conclusions to be derived from this investigation are:—

(1). That cyclones originating over the Arabian Sea are formed on the northern limits of the south-west monsoon, so that the place of origin of cyclones undergoes an annual oscillation, agreeing with those limits.

(2). That when the northern limits of the monsoon reach the land of India and Southern Asia, no cyclones are formed over the Arabian Sea.

(3). That when the north-east monsoon extends uninterruptedly from Southern Asia to the Equator, *i.e.* from December to March, no cyclones are formed over the Arabian Sea.

(4). That the epochs of greatest cyclone frequency are the beginning of June and the beginning of November.

(5). That during the pre-monsoon period the progressive motions of cyclones is carried out along a curved path, the commencement of which is near the Maldive or

Summary of conclusions.

Laccadive islands, the vertex about opposite Bombay and the conclusion near the Kooria Mooria Islands.

(6). That during the post-monsoon period the progressive motion of cyclones is along a curved path originating near the Maldives or Laccadives, the first part of which runs to north-west, the central portion to north-west and through north to north-east, and the concluding portion to east, and ending on the Konkan or Katthiawar coasts.

(7). That the diurnal progression of the vortex, when first produced, is irregular, but that it subsequently becomes steady, though the rate of advance always shows some decrease when the system is curving through north.

(8). That the initial stages of a cyclone are often characterised by the appearance of an abnormal northerly wind and fine weather, but not by long continued calms.

(9). That the barometric fall is gradual and equal on all sides, and that it is only near the centre that the mercury falls fast; that a depression of 0·25″ below the normal average pressure of the place of observation is indicative of the existence of a cyclone in the neighbourhood of that place.

(10). That when the hurricane is well out at sea, gusty strong winds are felt for several hundred miles around the centre, but that when the storm is in confined waters, the gale may burst with great suddenness.

(11). That the most tempestuous winds are felt on the margin of the calm area.

(12). That a ship, or steamer not using her engines, will enter and leave the calm centre with winds from opposite directions.

(13). That heavy rain is experienced on all sides of the storm focus, but is heaviest on its northerly octants.

(14). That a cross, confused sea accompanies the cyclone, and is felt 300 or 400 miles away from the storm centre.

(15). That occasionally cyclones appear to enter the Arabian Sea from the Indian Peninsula; that when this occurs the effects are very little felt over the strip of sea close to the coast, where the mountains on the west coast are close to the sea, but that where the mountains are at some distance inland, all the phenomena of a passing cyclone are experienced.

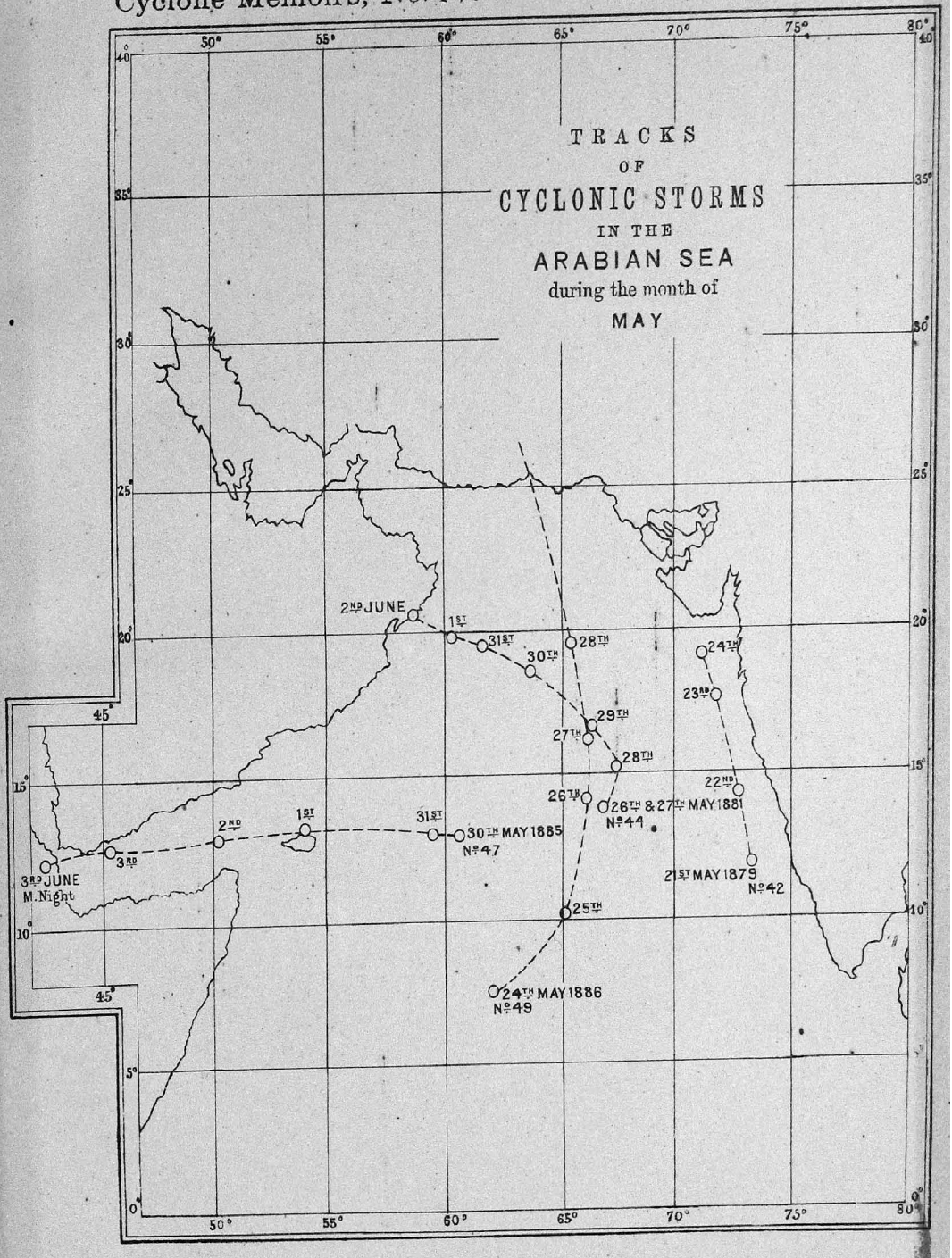
(16). That the north of the Arabian Sea is liable, during the prevalence of the north-east monsoon, to be disturbed

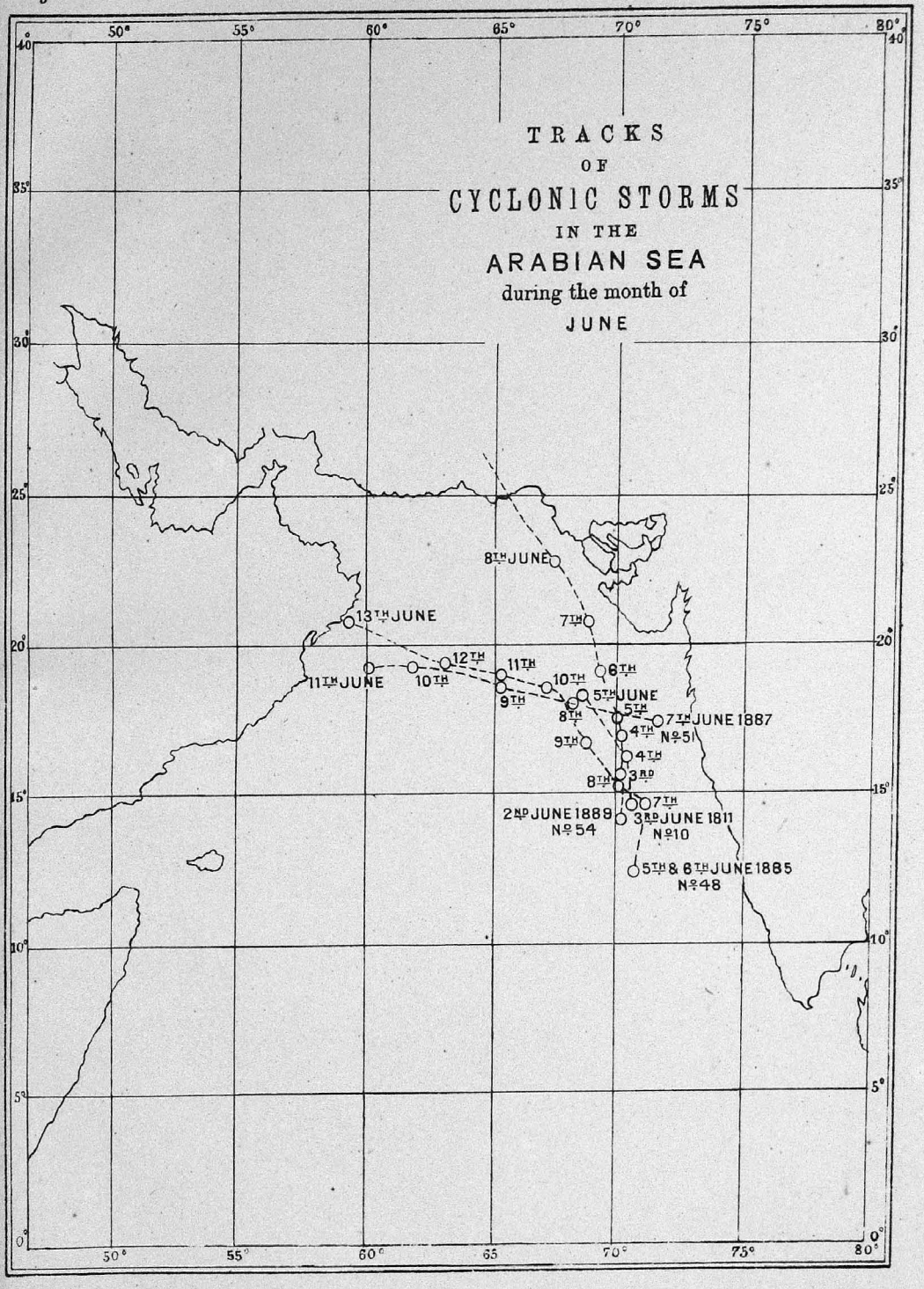
Summary of conclusions.

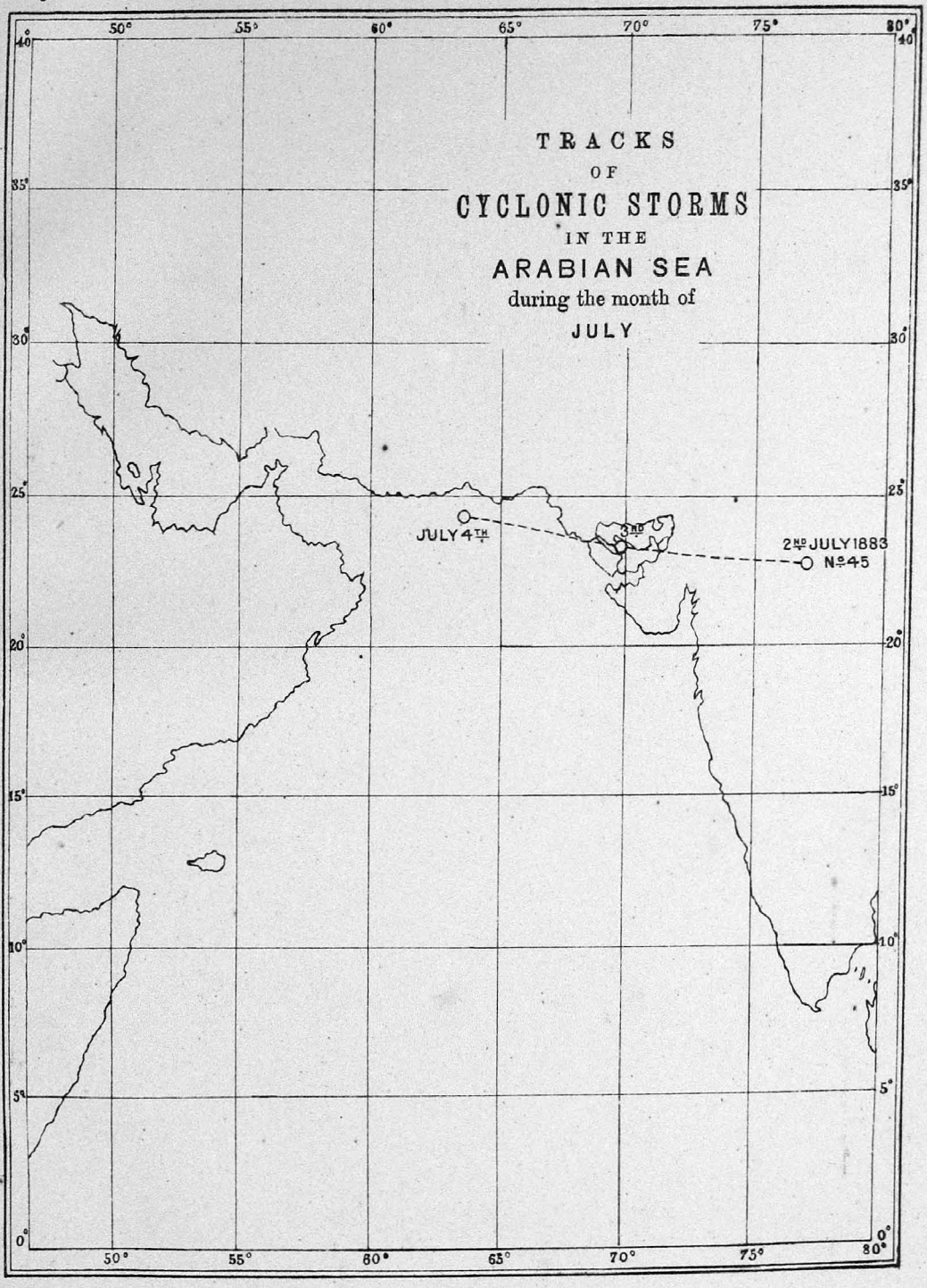
by small cyclonic storms descending from the highlands of Persia and Baluchistan.

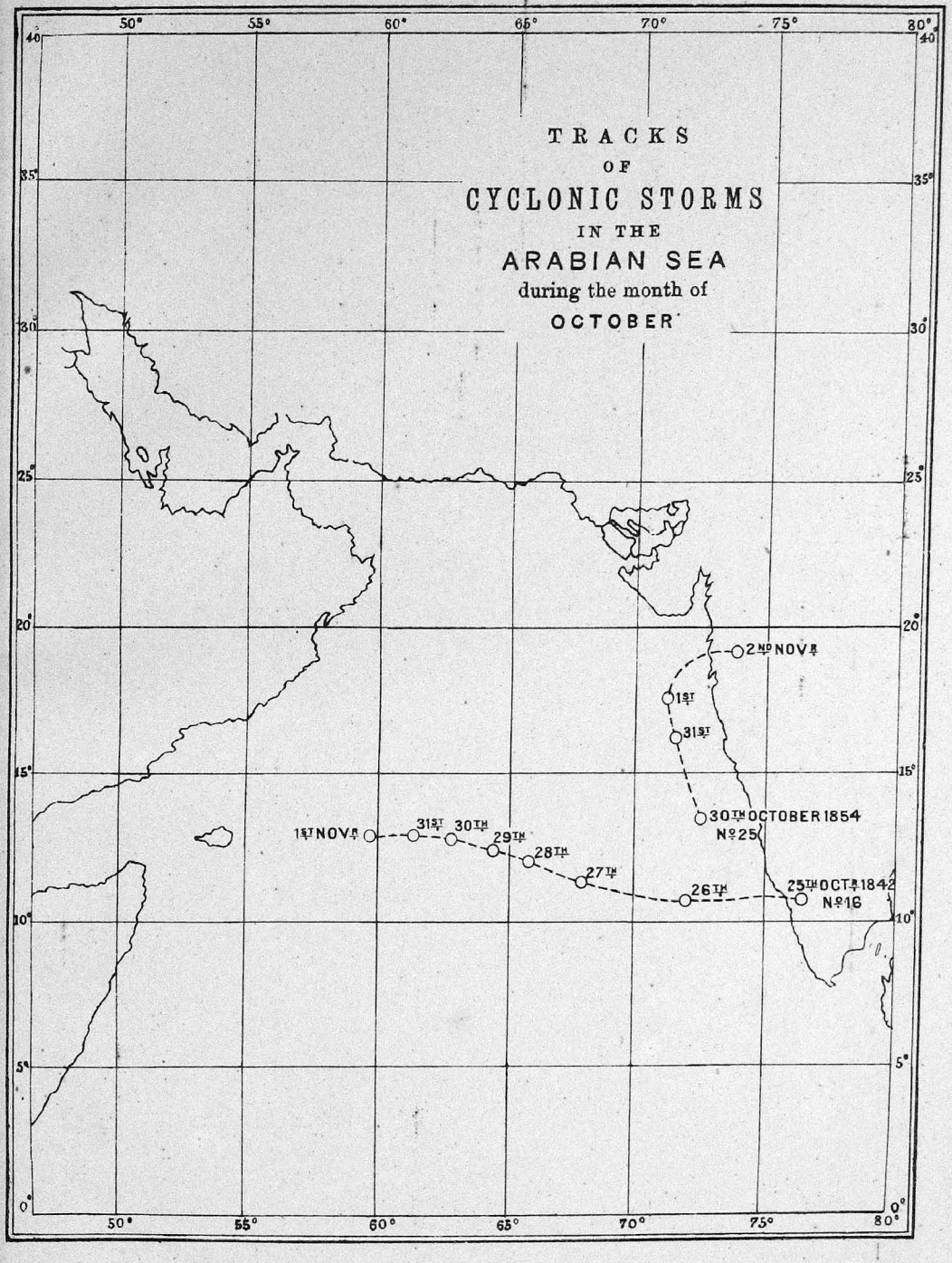
(17). That the whole of the south-west of the Arabian Sea, though liable to south-west gales during the summer monsoon, and to strong north-east winds during the winter monsoon, is free from cyclones.

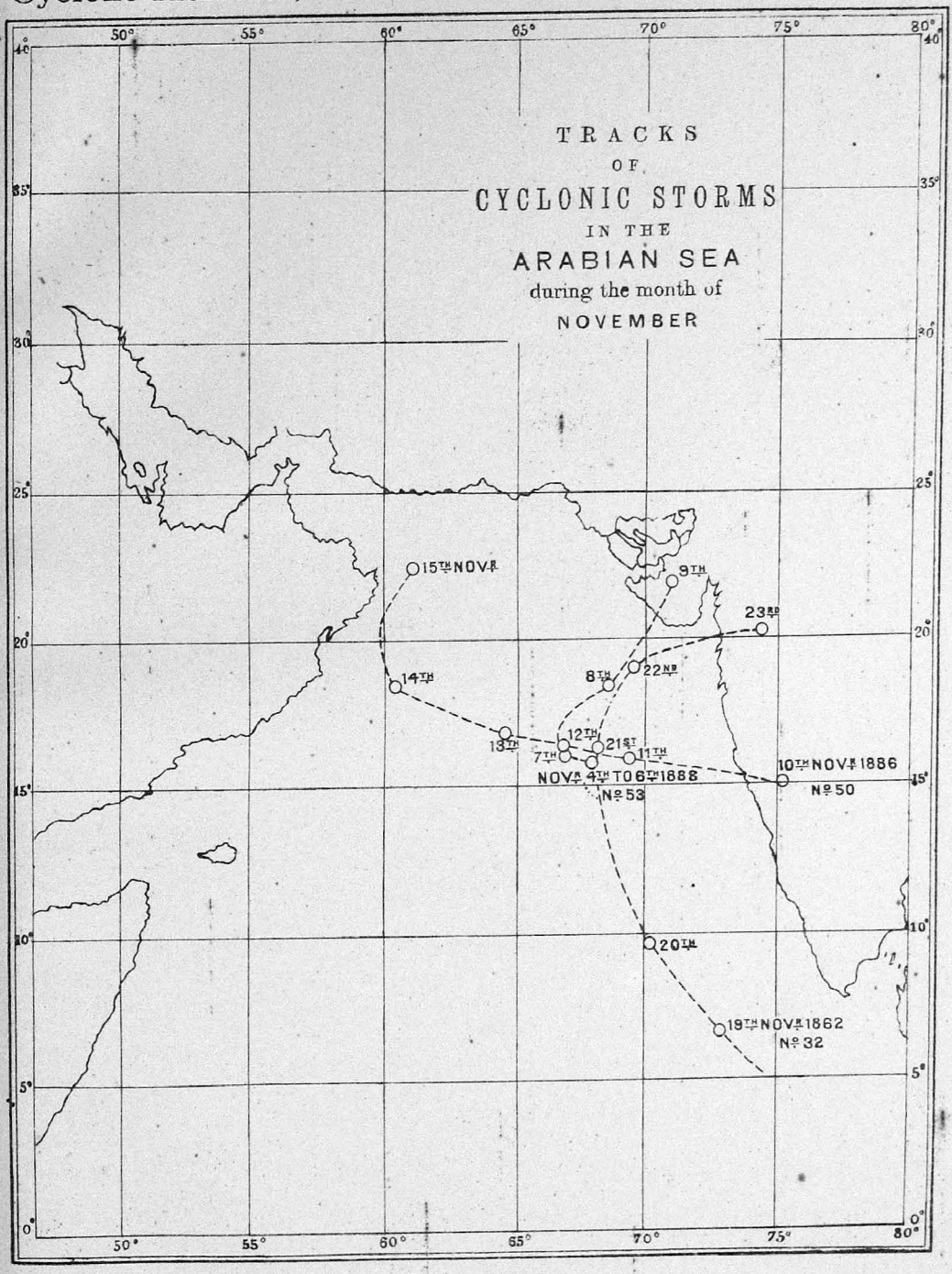
G. I. C. P. O.—No. 51 Metio.—3-7-91.—455.

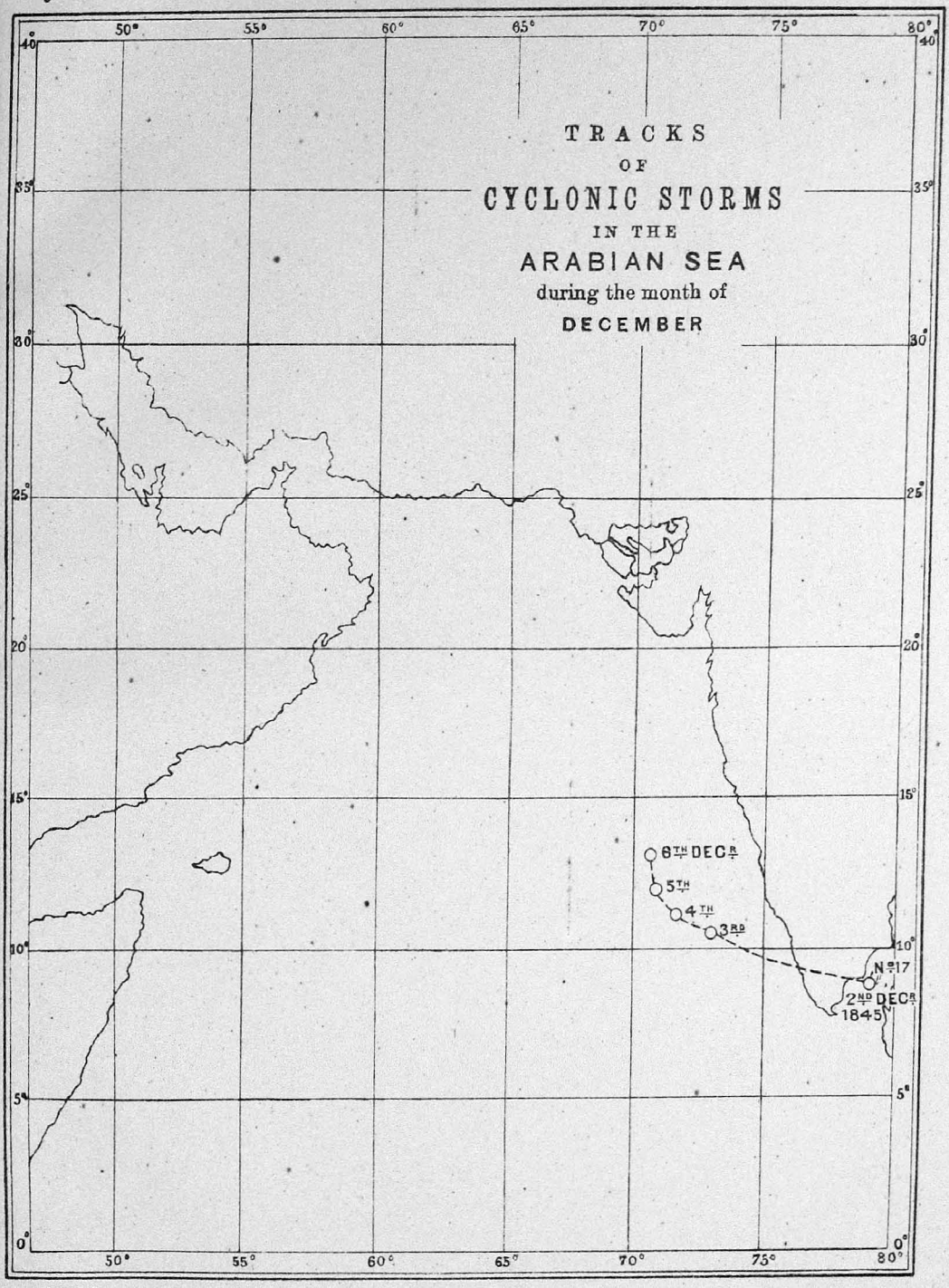

TRACKS
OF
CYCLONIC STORMS
IN THE
ARABIAN SEA
during the month of
MAY
2ND JUNE
1ST
31ST
30TH
28TH
29TH
27TH
28TH
24TH
23RD
22ND
26TH
26TH & 27TH MAY 1881
No 44
30TH MAY 1885
No 47
2ND
1ST
31ST
3RD
3RD JUNE
M. Night
21ST MAY 1879
No 42
25TH
24TH MAY 1886
No 49
40°
35°
30°
25°
20°
15°
10°
5°
0°
45°
50°
55°
60°
65°
70°
75°
80°


TRACKS
OF
CYCLONIC STORMS
IN THE
ARABIAN SEA
during the month of
JUNE
50°
55°
60°
65°
70°
75°
80°
40°
35°
30°
25°
20°
15°
10°
5°
0°
8TH JUNE
13TH JUNE
7TH
12TH
11TH
11TH JUNE
10TH
10TH
6TH
9TH
5TH JUNE
8TH
5TH
7TH JUNE 1887
4TH
No 51
9TH
4TH
3RD
8TH
7TH
2ND JUNE 1888
No 54
3RD JUNE 1811
No 10
5TH & 6TH JUNE 1885
No 48


TRACKS
OF
CYCLONIC STORMS
IN THE
ARABIAN SEA
during the month of
JULY
JULY 4TH
3RD
2ND JULY 1883
No 45
50°
55°
60°
65°
70°
75°
80°
40°
35°
30°
25°
20°
15°
10°
5°
0°


TRACKS
OF
CYCLONIC STORMS
IN THE
ARABIAN SEA
during the month of
OCTOBER
50°
55°
60°
65°
70°
75°
80°
40°
35°
30°
25°
20°
15°
10°
5°
0°
2ND NOV.R
1ST
31ST
30TH OCTOBER 1854
No 25
1ST NOV.R
31ST
30TH
29TH
28TH
27TH
26TH
25TH OCT.R 1842
No 16

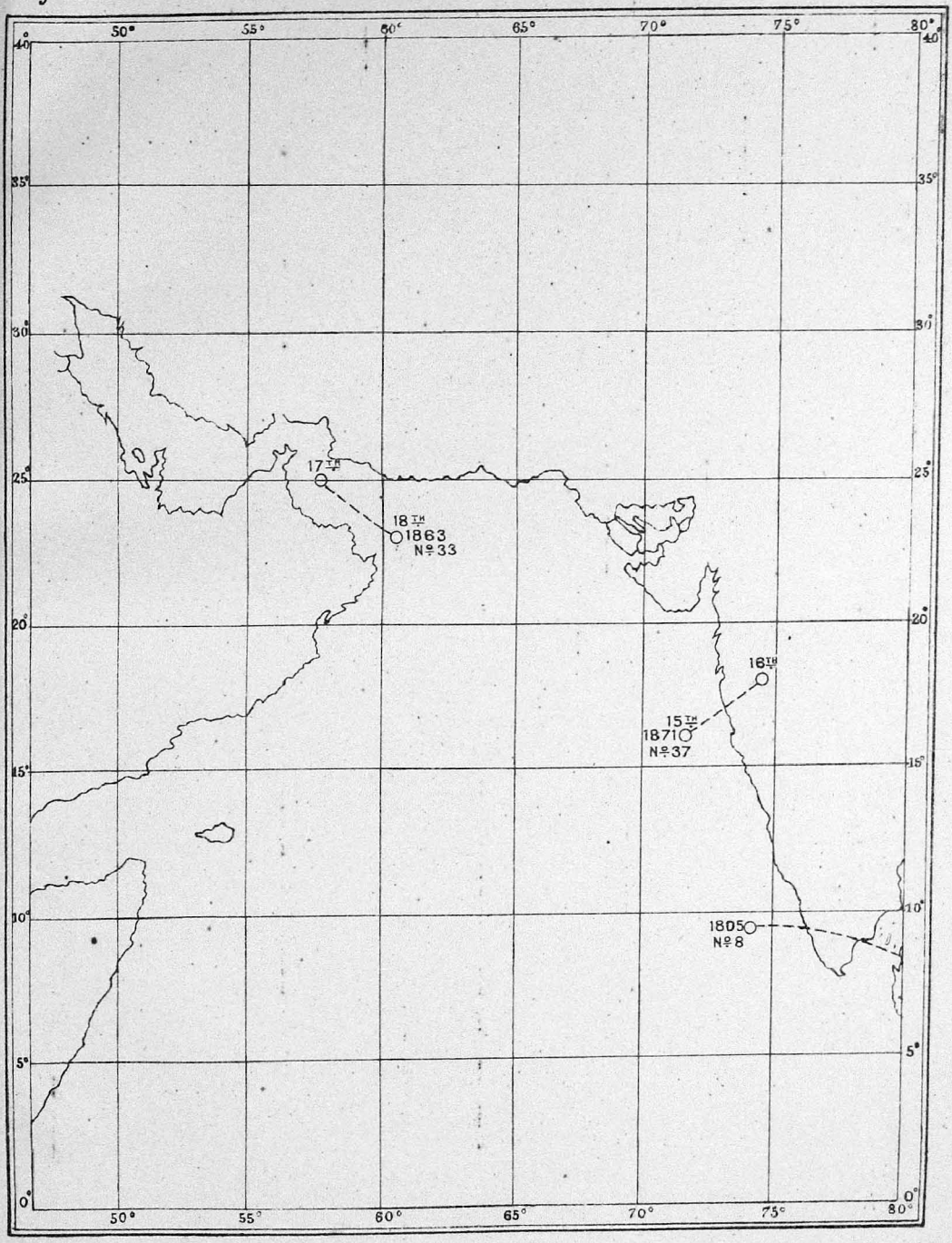

TRACKS
OF
CYCLONIC STORMS
IN THE
ARABIAN SEA
during the month of
NOVEMBER
15TH NOV.R
9TH
23RD
14TH
8TH
22ND
13TH
12TH
21ST
7TH
11TH
10TH NOV.R 1886
NOV.R 4TH TO 6TH 1888
No 53
No 50
20TH
19TH NOV.R 1862
No 32
50°
55°
60°
65°
70°
75°
80°
40°
35°
30°
25°
20°
15°
10°
5°
0°


TRACKS
OF
CYCLONIC STORMS
IN THE
ARABIAN SEA
during the month of
DECEMBER
50°
55°
60°
65°
70°
75°
80°
40°
35°
30°
25°
20°
15°
10°
5°
0°
6TH DECR
5TH
4TH
3RD
No 17
2ND DECR
1845

POSITIONS AND HYPOTHETICAL COURSES OF STORMS FOR WHICH NO DEFINITE INFORMATION AVAILABLE.

JANUARY

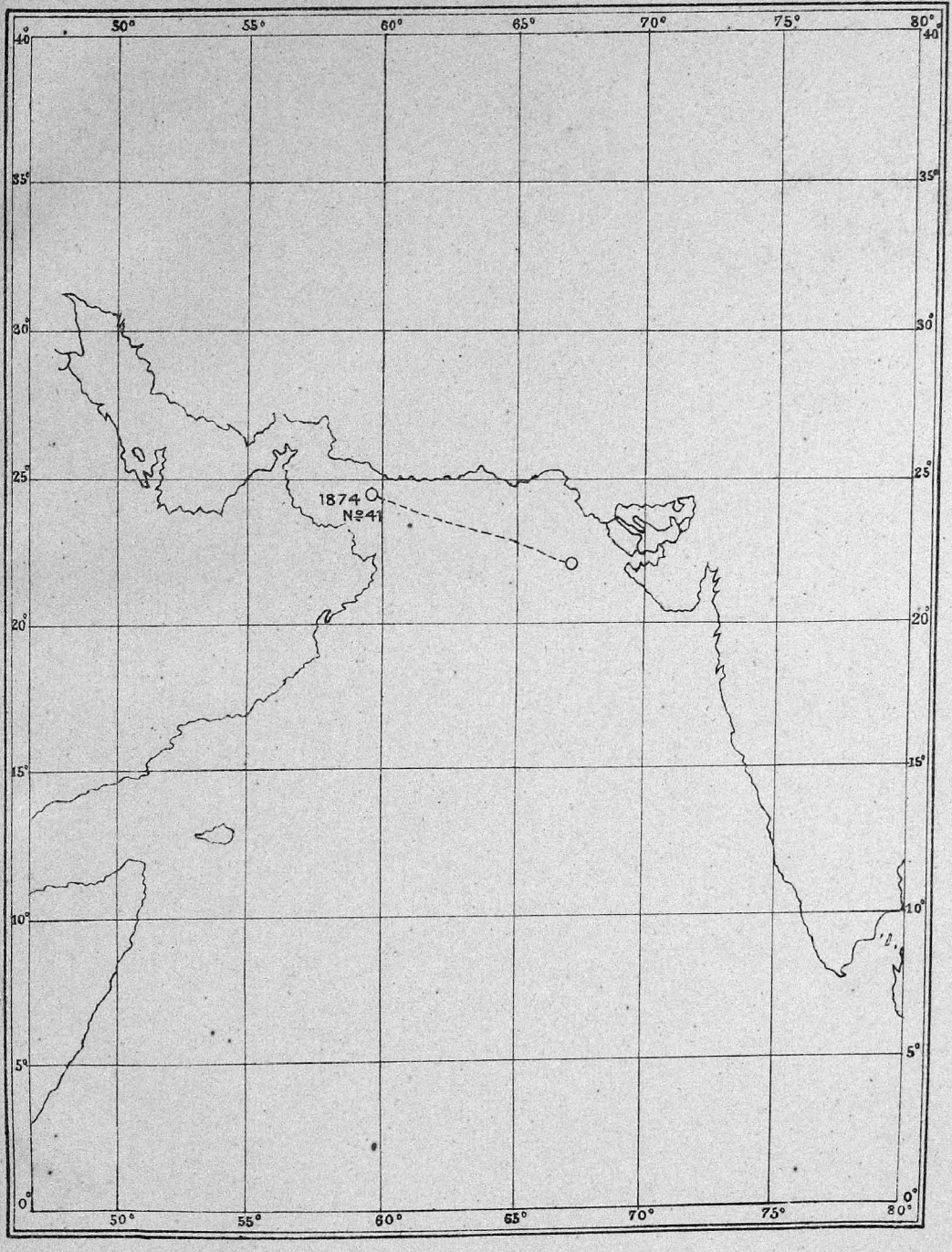
Cyclone Memoirs, No. IV. Plate LV.



POSITIONS AND HYPOTHETICAL COURSES OF STORMS FOR WHICH NO DEFINITE INFORMATION AVAILABLE.

MARCH

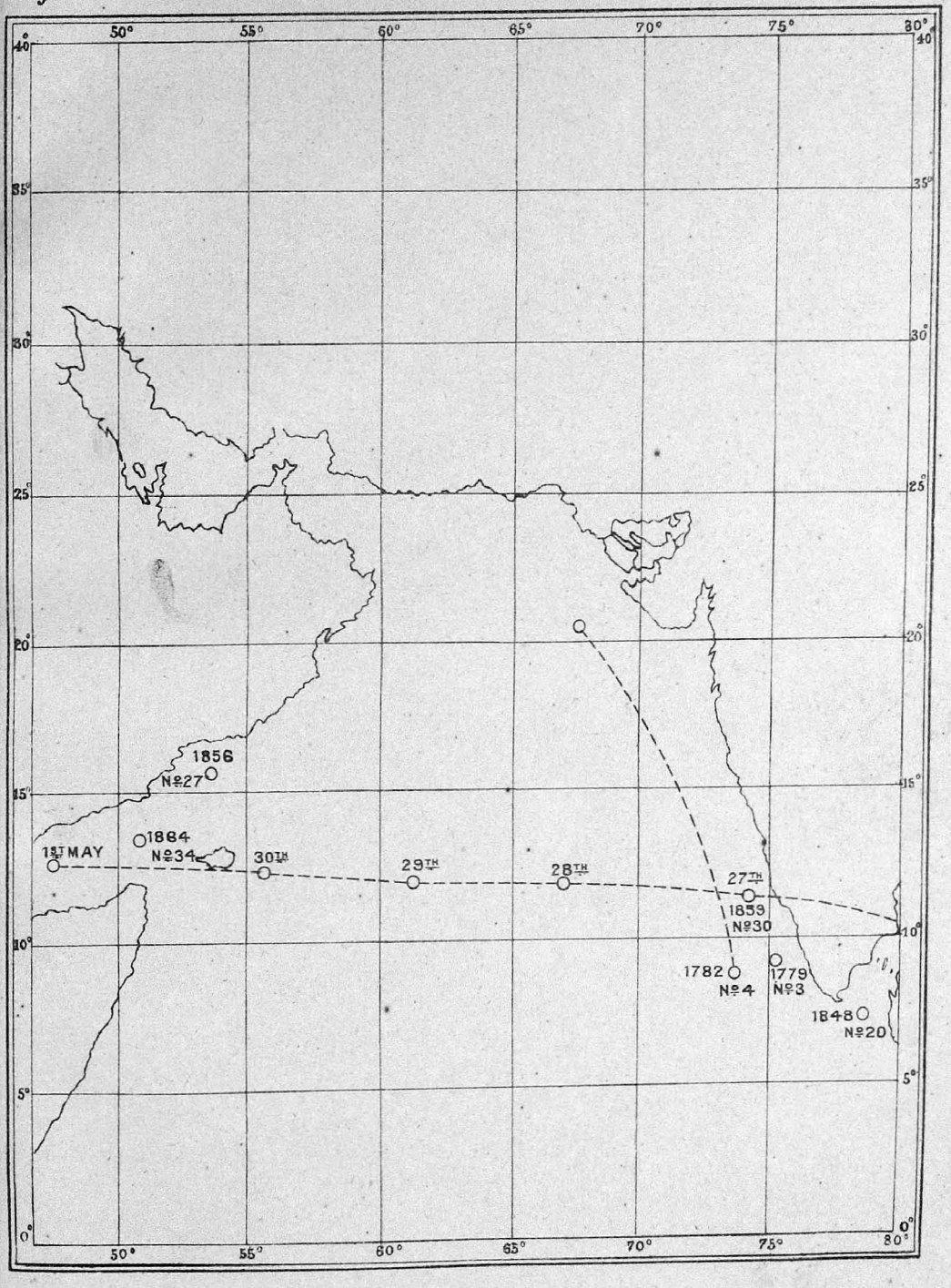
Cyclone Memoirs, No. IV. Plate LVI.



POSITIONS AND HYPOTHETICAL COURSES OF STORMS FOR WHICH NO DEFINITE INFORMATION AVAILABLE.

APRIL

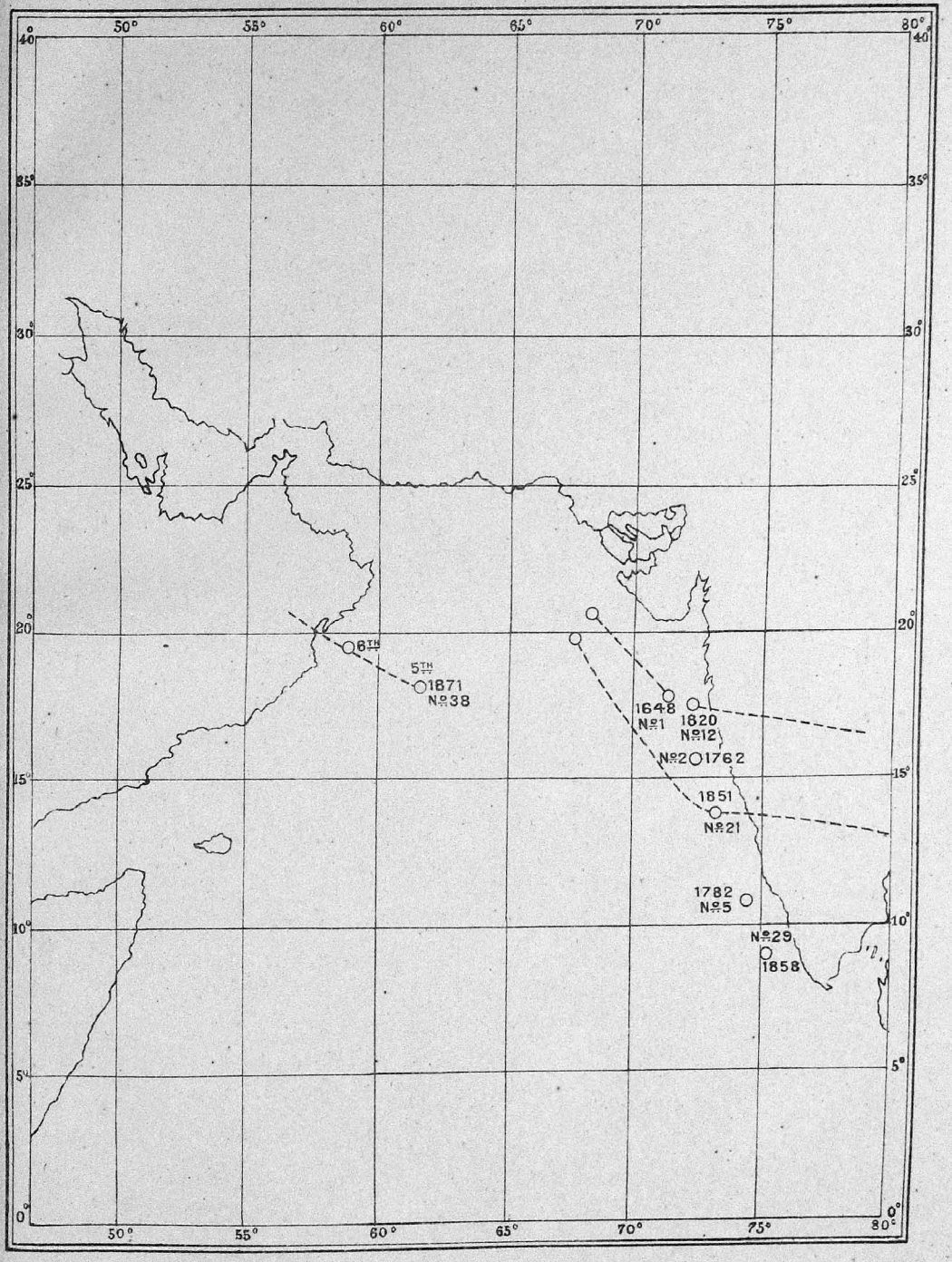
Cyclone Memoirs, No. IV. Plate LVII.



POSITIONS AND HYPOTHETICAL COURSES OF STORMS FOR WHICH NO DEFINITE INFORMATION AVAILABLE.

MAY

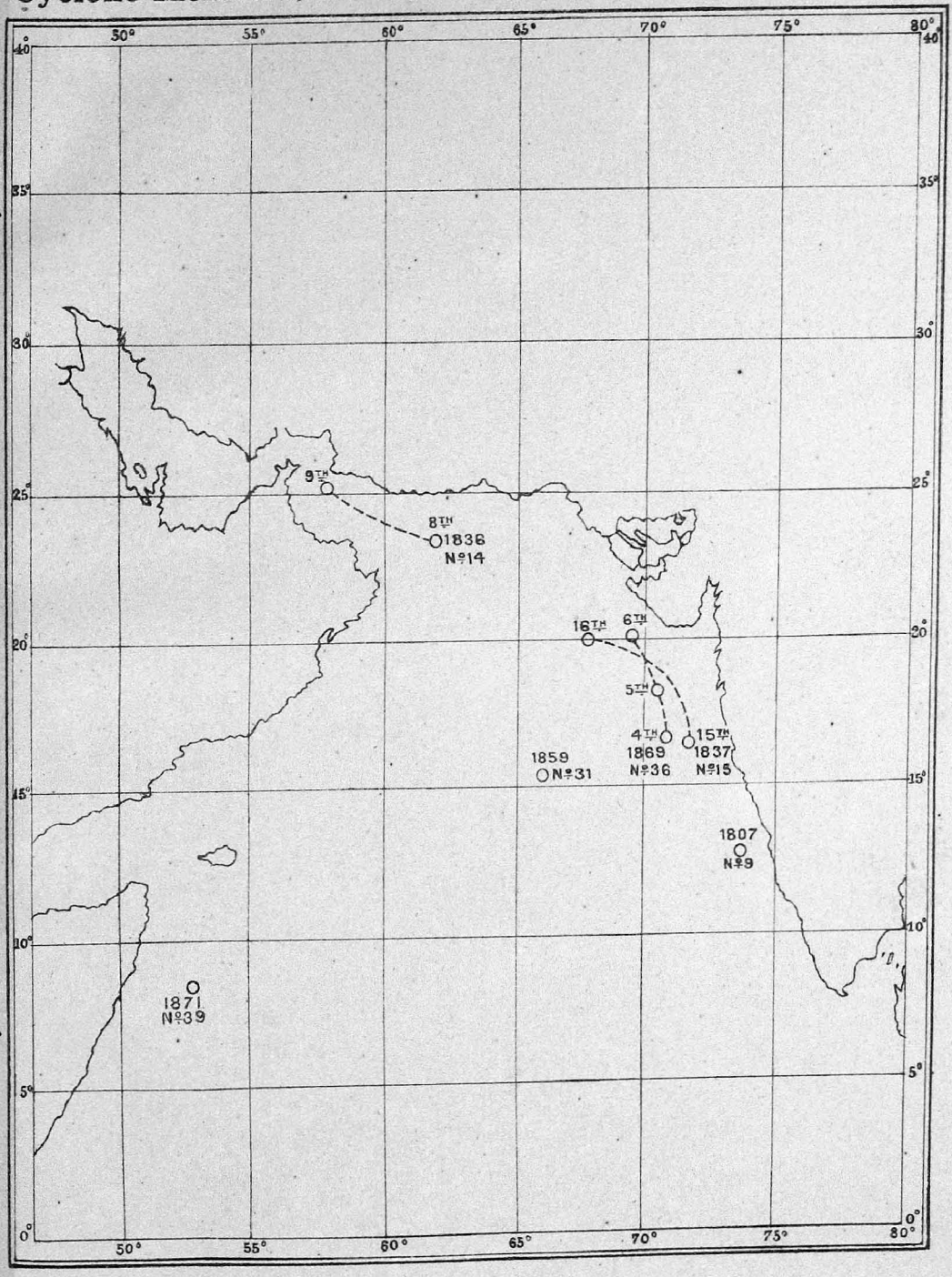
Cyclone Memoirs, No. IV. Plate LVIII.



POSITIONS AND HYPOTHETICAL COURSES OF STORMS FOR WHICH NO DEFINITE INFORMATION AVAILABLE.

JUNE

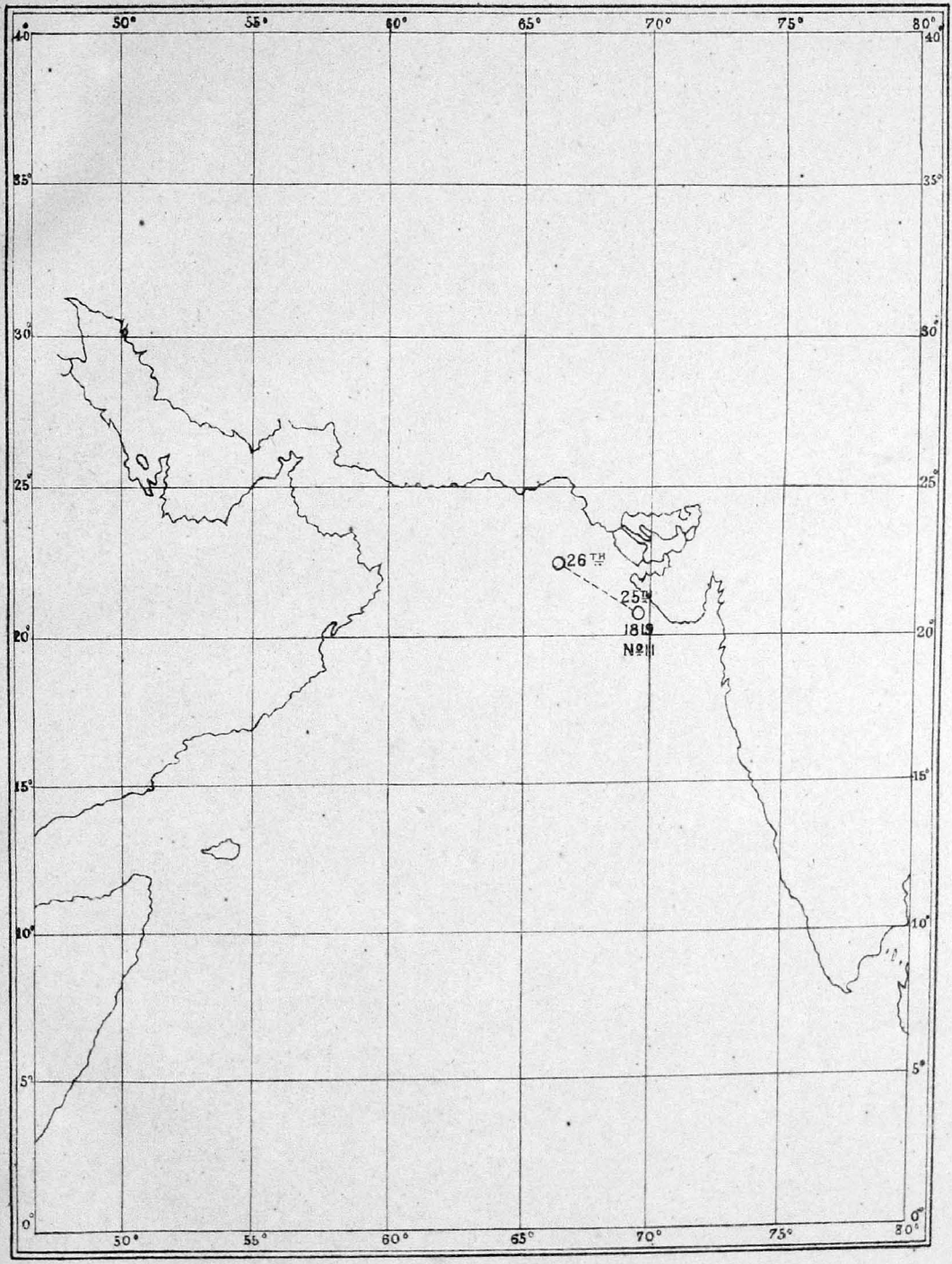
Cyclone Memoirs, No. IV. Plate LIX.



POSITIONS AND HYPOTHETICAL COURSES OF STORMS FOR WHICH NO DEFINITE INFORMATION AVAILABLE.

SEPTEMBER

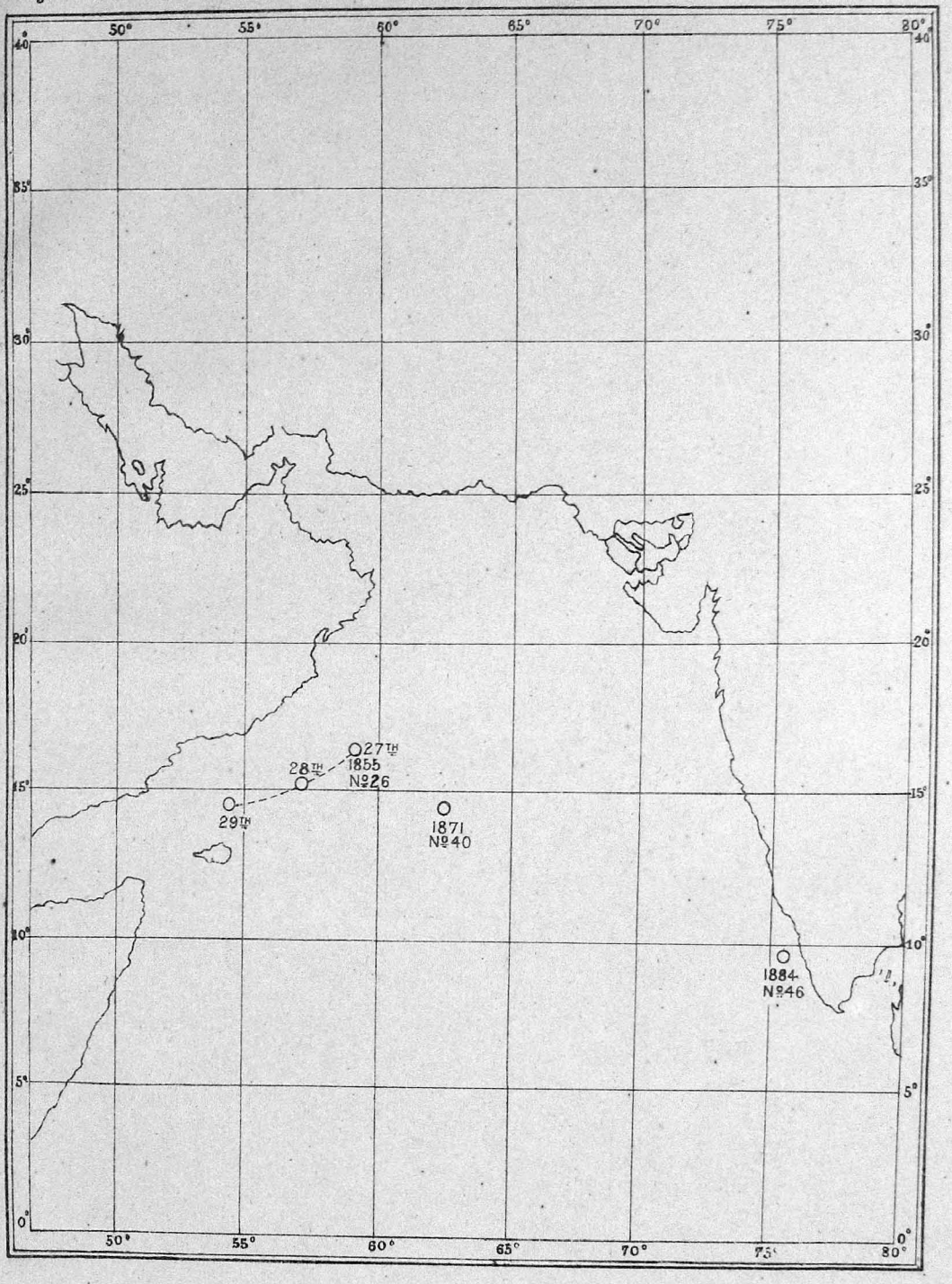
Cyclone Memoirs, No. IV. Plate LX.



POSITIONS AND HYPOTHETICAL COURSES OF STORMS FOR WHICH NO DEFINITE INFORMATION AVAILABLE.

OCTOBER

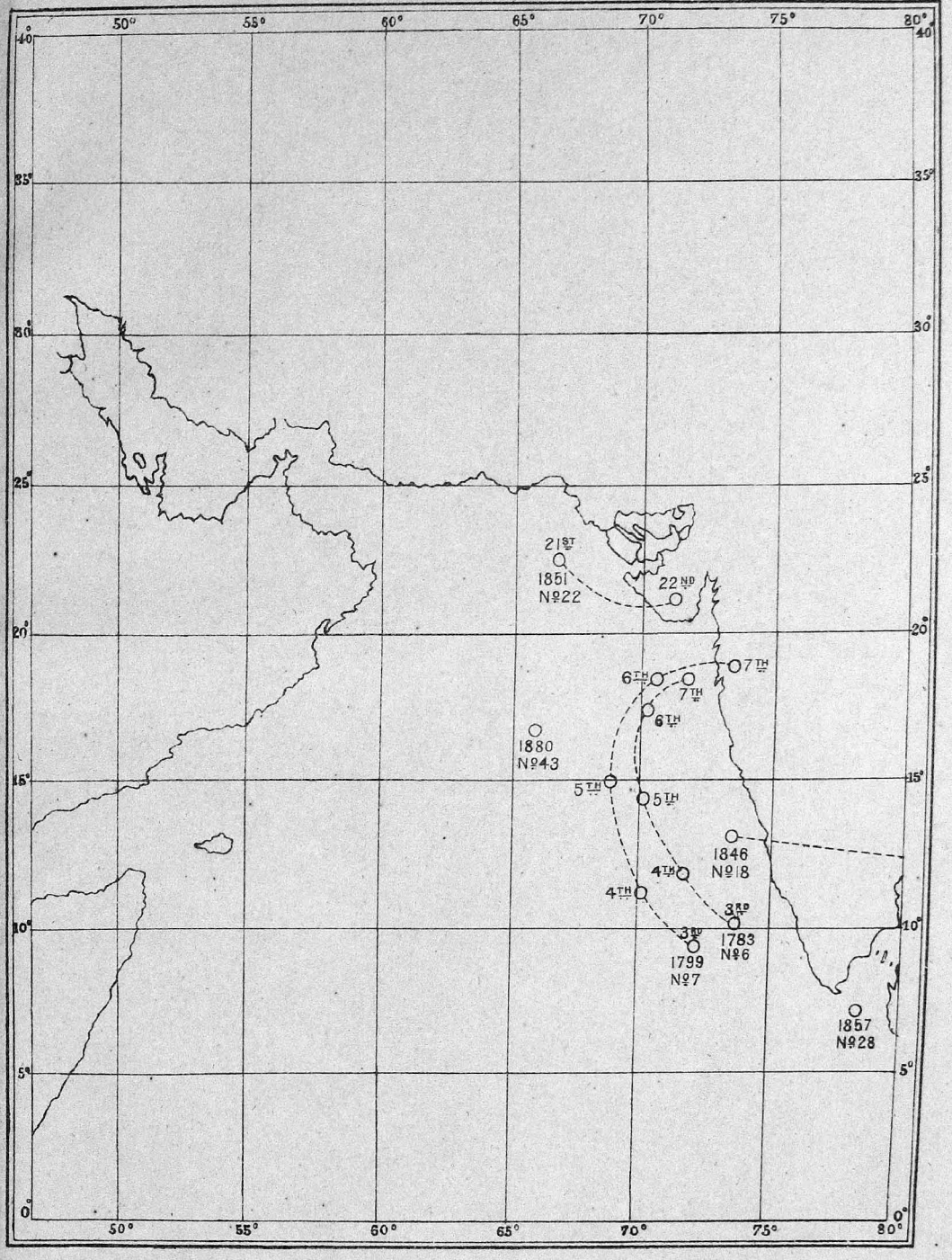
Cyclone Memoirs, No. IV. Plate LXI.



POSITIONS AND HYPOTHETICAL COURSES OF STORMS FOR WHICH NO DEFINITE INFORMATION AVAILABLE.

NOVEMBER

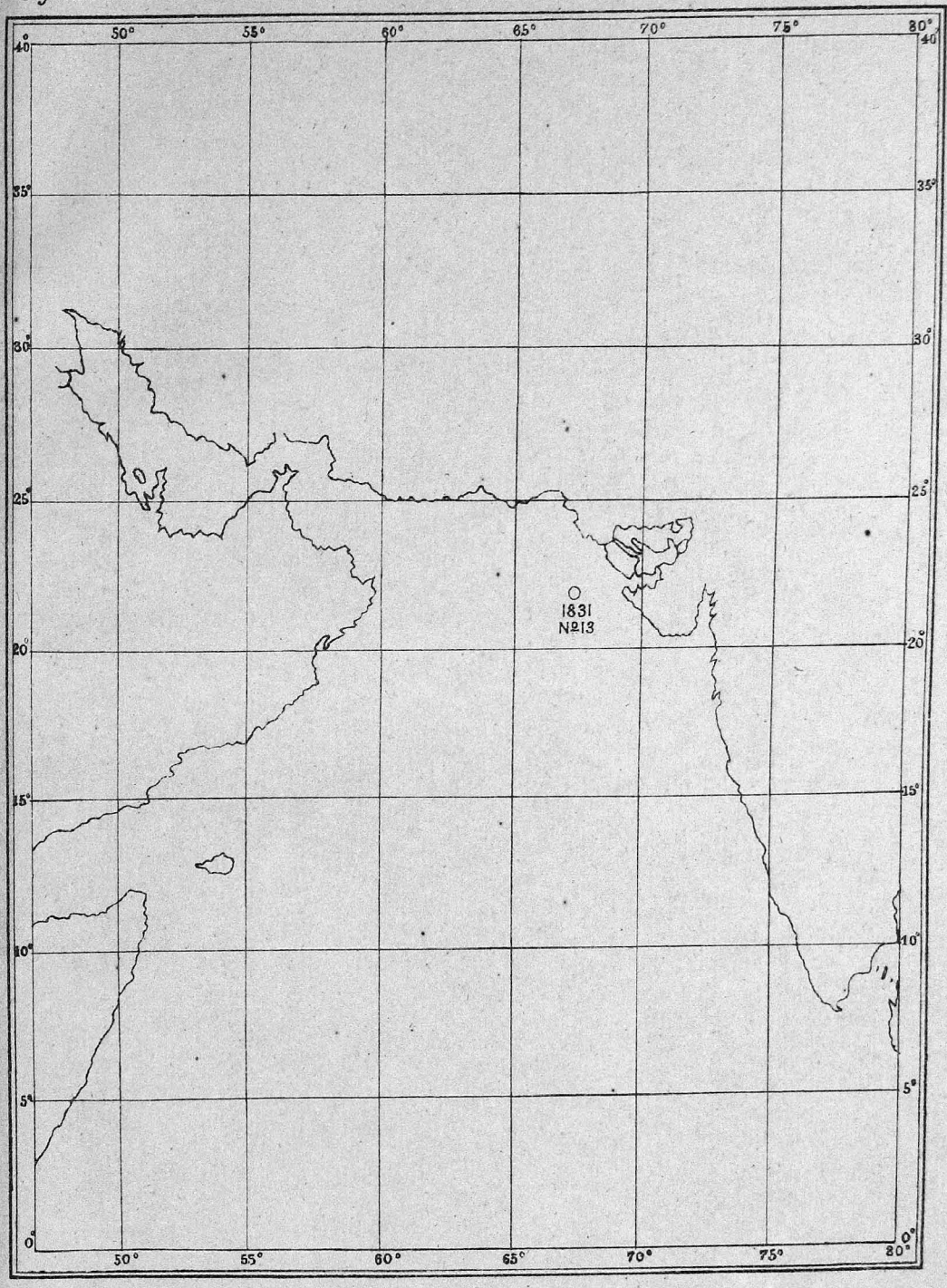
Cyclone Memoirs, No. IV. Plate LXII.



POSITIONS AND HYPOTHETICAL COURSES OF STORMS FOR WHICH NO DEFINITE INFORMATION AVAILABLE.

DECEMBER

Cyclone Memoirs, No. IV. Plate LXIII.



80°
70°
60°
50°
40°
30°
20°
10°
N
10°
20°
30°
40°
50°
60°
70°
80°
Spaces = 50 Miles.
November Curve....
May..... do .....
• • = Days after movement commenced

CYCLONE MEMOIRS.

PART IV.

ARABIAN SEA.

AN INQUIRY

INTO THE

NATURE AND COURSE OF STORMS

IN THE

ARABIAN SEA

AND A

CATALOGUE AND BRIEF HISTORY OF ALL RECORDED CYCLONES IN THAT SEA

From 1648 to 1889.

BY

W. L. DALLAS, ESQ.,

Assistant Meteorological Reporter to the Government of India.

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J. ELIOT, M.A.,

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1891.